LIBRARY OF CONGRESS
COPYRIGHT
FEB 25 1889
652
WASHINGTON

PRICE 15 CENTS.

FEBRUARY 23, 1889.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XXV. REGULAR EDITION NO. 687.

ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

TICKNOR & COMPANY

BOSTON MASS.

CONTENTS.

Editorial Summary.
Builders' Hardware.—XIX.
Architectural Shades and Shadows.—I.
Earthquakes.—I.
Books and Papers.
Building-Law.
Societies.
Communications.
Notes and Clippings.
Trade Surveys.

ILLUSTRATIONS.

House of Mrs. Eldridge, Ochre Point, Newport, R. I.
(Gelatine Print issued only with Imperial Edition.)
Architectural Shades and Shadows, Plate I.
Church, Ann Arbor, Mich.
One Design for the Proposed Municipal Building, Washington, D. C
Cottage at Watch-Hill, R. I.
Probate Office, E. Cambridge, Mass.

REVIEW OF THE PRINCIPLES OF SANITARY PLUMBING AS NOW ACCEPTED BY ALL LEADING SANITARIANS.

THE main object to be attained is the complete removal of waste matters from the premises the instant they are generated. This can only be accomplished by observing the following rules:—(1.) Avoid all cesspools. (2.) Make all waste-passages as small as possible to effect their purposes. (3.) Construct every fixture on the principle of the flush-tank. (4.) Make every trap seal-retaining and self-scouring. (5.) Make all joints tight. (6.) Select the simplest appliances and the simplest system consistent with safety. These rules are self-evident enough to be accepted as plumbing axioms, and are sufficient to produce perfect work. The "Sanitas" Appliances have been constructed with a view to their fulfilment in every respect, and an examination of the steps leading to the development of these appliances will best illustrate the principles of Sanitary Plumbing, showing the faults which should be avoided, and the objects which should be sought.

Beginning with the trap: In the first place mechanical seals have been discarded as being unreliable, unnecessary, and as obstructing the water-way. We start with the simplest form of water-seal trap, the ordinary S-trap. This

trap answers all our requirements except that it has no power to retain its seal under the variations of atmospheric pressure occuring within the waste-pipes. To remedy this deficiency the pot-trap was developed from the S-trap by simply enlarging its upcast limb, a sufficient enlargement gives it a temporary power of resistance, but creates a cesspool having no self-cleansing power

and, accordingly, the trap clogs, under sinks, with grease and ultimately loses its original resisting power. To avoid this difficulty we have turned the pot-trap on its side and reduced the size of its body. This permits the air to pass through the trap above the water without driving the latter out

before it, as would be the case with a perpendicular body equally reduced in diameter. To still further increase the power of resistance to siphonage the body was next bent into a quadrangle, giving several reflecting surfaces, which throw back this water under siphoning action while they allow the air to escape, and, finally, the two parallel sides of the quadrangle were merged into a single body having a reflecting partition and a large clean-out cap. This gives us the perfected Sanitas-Trap, which

has proved itself to be both anti-siphonic in properly arranged plumbing-work and substantially self-cleansing either with or without venting. It is more resisting than a vented S-trap.

The Sanitas Is a Scientific System of Plumbing, having Simplicity and Safety for its Basis. It is also by far the most Economical System

SANITAS

APPLIANCES

PLUMBING

Avoid Infringements and Imitations which are described as being "as good as the 'Sanitas;'" they are not, they are very inferior as well as illegal.

Considering next the Lavatory. These should always be constructed on the principle of the flush-tank, their discharges filling the water-passages "full-bore," so as to keep them clean. The overflow and outlet passages should be combined in the form of a stand-pipe, thus doing away with the usual foul, inaccessible and badly jointed lead overflow-pipe, and the troublesome and dirty plug and chain. The stand-pipe should be operated by a simple mechanism above the slab, for convenience and cleanliness, requiring but a single movement of the hand, and all parts should be of solid and durable construction, while the stand-pipe should be easily detachable for cleansing. The Sanitas Lavatories are all constructed after this principle, and they are the first ever so constructed. The stand-pipes are made of either plated metal or of earthenware, like the fixture itself, and the whole device produces a very ornamental effect, especially when decorated in colors to correspond with the decoration of the earthenware bowl. Finally, the ideal water-closet should have the simplicity of the short-hopper, with the sanitary advantages and convenience of the improved modern closets. More than this, it should be practically noiseless, anti-siphonic, quick-acting, self-sealing, and free from spattering or waste of water. These desiderata have been attained in the Sanitas Water-Closet of which we sketch the outline in section. The supply-pipe between the cistern and the closet discharges into the latter below the level of its standing water, and being without air-pipe, stands permanently full of water, hence the action is instantaneous and the noise of flushing is deadened. This and the peculiar construction of the flushing-rim and water-supply passages cause the waste to be discharged with wonderful speed and effectiveness; and at the same time so quietly that with the cover down and the toilet-room door closed, no sound of flushing can be heard from without. The closet is highly ornamental in appearance, hence no other wood-work is required than the seat and cover, and these may be supported directly on the earthenware itself, which is constructed with this in view. The Sanitas System, taken together, is the most economical as well as the only safe system of plumbing, as avoiding the dangers and complication of special trap venting. Whether vented or not it is now admitted that safety requires a trap to be *anti-siphonic*, the vent-pipe alone not being reliable. The Sanitas Trap holds sufficient water to resist, when properly set, any *back pressure* that can occur in good plumbing with properly vented soil-pipes. ● For more detailed description and illustration of the Sanitas Appliances, see our other Advertisements and the Circulars of

THE SANITAS MANUFACTURING CO., BOSTON.

Branch Offices: 64 Gold Street, New York, N. Y. 229 Walnut Street, Cincinnati, O. 47 to 49 Dearborn Street, Chicago, Ill. 316 Chestnut Street, St. Louis, Mo. Sole Agents for California: Arnold & Co., 40 California Street San Francisco. Sole Agent for Canada: O. Higman, 236 Sparks Street, Ottawa.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXV. Copyright, 1889, by TICKNOR & COMPANY, Boston, Mass. No. 687.

FEBRUARY 23, 1889.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

SUMMARY: —
The Death of Edward S. Philbrick, Engineer. — Fall of Ten Floors in the Owens Building, Chicago. — Convention of the National Association of Master-Builders. — The Papier-Maché Ceiling over the Albany Assembly-Chamber. — Hose-holes in Fireproof Shutters. — A Travelling Electric Light. — Baron von Schmidt made a Peer. 85
BUILDERS' HARDWARE. — XIX. 87
ARCHITECTURAL SHADES AND SHADOWS. — I. 88
ILLUSTRATIONS: —
House of Mrs. Eldridge, Ochre Point, Newport, R. I. — Architectural Shades and Shadows, Plate I. — Church, Ann Arbor, Mich. — One Design for the Proposed Municipal Building, Washington, D. C. — Cottage at Watch-Hill, R. I. — Probate Office, East Cambridge, Mass. 90
EARTHQUAKES. — I. 90
BOOKS AND PAPERS. 92
BUILDING LAW. 92
SOCIETIES. 94
COMMUNICATIONS: —
Greek Architecture. — Toronto Board of Trade Competition. — The Columbia College Architectural Course. 94
NOTES AND CLIPPINGS. 95
TRADE SURVEYS. 96

THE profession of architecture, as well as that of engineering, has suffered a loss in the death of Mr. Edward S. Philbrick, who died last week very suddenly, like so many other members of what may well be termed the anxious professions, on his way in the train from Boston to his home in Brookline. Mr. Philbrick was born in Brookline sixty-one years ago, and was therefore hardly past the prime of his energy and usefulness at the time of his death. He graduated at Harvard College, and travelled extensively abroad while a young man. Being naturally clear-headed and observing, as well as energetic and industrious, he soon attained a high rank in his chosen profession of engineering, and the diversity of the commissions entrusted to him, with his signal success in all of them, show that his abilities were of no common order. Early in his career he was engineer to the Boston and Albany Railroad, the most important road in Massachusetts; but his independent and investigating spirit found greater satisfaction in general practice, which presented more varied and difficult problems to be solved; and most of his professional life was spent in this way. He was still quite a young man when he was chosen to represent the State of Massachusetts as engineer in the construction of the Hoosac Tunnel, and many of the most important works of water-supply and drainage in the State have been carried out either under his direction, or with help of his advice as consulting engineer. Of late years he had been much interested in sanitary engineering, rather, perhaps, as a study than a source of profit; and the books and published articles in which he gave the results of his extended experience still form a very valuable part of the literature of sanitation. Personally, Mr. Philbrick was remarkable for the dispassionate and truth-loving spirit with which he treated the problems presented to him. He had no theories, no prejudices, and no hollow enthusiasms. While he was far too kind and conscientious to reject another person's notions merely for the sake of showing the superiority of his own, he would accept no conclusion, either from himself or other people, which could not be shown to rest on a solid basis of facts; and it was, perhaps, the knowledge of this characteristic which made him more sought after, as a general consulting engineer, than any other person in the State. Although the distractions incident to the management of a large amount of property, belonging to himself and others, interfered with the number and extent of the professional commissions which he was able to carry out, they never interfered with his love for science, or prevented him from attending to the minutest details of the work which he undertook. They did, however, probably limit to some extent his reputation. It was inevitable that he should not sometimes have had to choose between staying at home, to look out for the interest and comfort of his aged mother and his own family, and accepting important commissions at a distance, which would be sure to bring him professional renown; but, notwithstanding his energetic disposition and his consciousness of his ability to carry them out successfully, he unhesitatingly chose the less brilliant, but more unselfish part, and spent contentedly at home in Brookline, or on his place at Newport, a life which he would not render more gratifying to his own ambition at the cost of the comfort of those dependent upon him.

TWO very strange building accidents have taken place this week. In Chicago, the Owens Building, a new fireproof structure, fifty feet square on the ground, and fourteen stories high, was almost completely ruined on Sunday morning by the failure of some of the terra-cotta blocks in the floors. The building was nearly completed, the floors, of iron beams filled-in with flat arches of terra-cotta blocks, were all in place, the roof was on, and the iron staircase was being put up. For some reason, a part of the terra-cotta filling in the tenth floor gave way, at a time when very few men were in the building, and fell to the floor below. The arching of this floor was also weak, and the shock of the fall of the blocks from above carried it away where they struck, and the whole fell together to the eighth floor, where the same effect was produced. By the time the increasing mass had reached the fifth floor its momentum had become irresistible, and this floor, together with all those beneath it, was torn out, beams and all, and precipitated to the cellar, while the walls on which the ends of the beams rested were so badly cracked and shaken that they may have to be pulled down. Fortunately, no one was in the upper stories, and at the sound of the fall of the first terra-cotta blocks in the ninth story, the men in the lower stories, some eight or nine in number, rushed into the street just in time to save their lives. The cause of the collapse of the floor will probably be easily determined by expert examination. It will be remembered that a somewhat similar accident took place in the United Bank Building in New York very soon after its completion, the terra-cotta blocks of several of the floors falling out by their own weight. In this case it was found that some of the workmen, who were unaccustomed to the use of the flat-arch blocks, had fitted them in upside down, so that they hung by the adhesion of the mortar, and even this was diminished by the fact that they were laid in winter, many of them without removing the ice which covered them, and that the mortar froze between them. As it happened, the floors in the New York building failed singly, so that nothing was necessary but to replace the blocks and refinish, but, under circumstances a little different, the result might have been very similar to that at Chicago. The other accident reported took place at Hartford, Conn., where a hotel, built only fifteen years ago, was blown up, perhaps by the explosion of the steam-boiler in the basement, although, as no fragments of the boiler have been found, this is doubtful, and eighteen or more persons were instantly killed, while many others were severely injured.

THE Third Annual Convention of the National Association of Master Builders was held in Philadelphia last week. From the reports in the daily papers we should say that, as is apt to be the case in conventions where the business is not previously laid out, and carried through with a strong hand, the work done was rather of the hand-to-mouth kind, the convention waiting until some one offered a resolution of some kind, and then passing or rejecting it, without looking to the establishment of any definite policy. Perhaps, however, the official report will make a different showing. Certainly, the leaders of the Association have ability and penetration enough to secure the adoption of a policy, if they see occasion for one. The most singular paper read before the convention appears to have been one sent by Mr. Hatfield of New York, but read by Mr. McArthur, in which the author is reported to have said that "the architect's position was that of an umpire, or judge, whose duty it was to guard the interests of the owner, as well as those of the builder." Why it should be the duty of the architect to guard the interests of the builder we are unable to imagine. That it is his duty to judge fairly, in controversies between the builder and the owner which he

is called in to decide, is evident enough, but that is a very different thing. However, as the paper is to be printed, and circulated among architects, as well as builders, we will not attempt to judge of it from newspaper reports. Colonel R. T. Auchmuty of New York, read a paper on "Trade Training," which was vigorously applauded, as was also its author, who concluded his reading by saying that the opposition of the trades' unions to the education of young men in such schools came from foreigners. He thought it ought not to be allowed to prevail, and called upon his hearers to control their own business, which, we venture to say, they are quite disposed to do. Resolutions in favor of exerting the influence of the Association against the repeal of the conspiracy laws, which is now being urged by the trades' unions in several States; of establishing a fire insurance company, under the auspices of the Association, to take builders' risks; and of endeavoring to secure legislation to restrain persons or associations from interfering with the efforts of American youths to learn any trade, were adopted; and Mr. E. J. Scribner, of St. Paul, was elected President for the ensuing year, Messrs. John J. Tucker of New York, and A. McAllister of Cleveland, Vice-Presidents, Mr. W. H. Sayward of Boston, Secretary, and Mr. George Tupper of Chicago, Treasurer.

THE investigation into the construction of the papier-maché ceiling over the Assembly Chamber at Albany is still going on, with endless charges, counter-charges, denials and rejoinders, but with very little result so far as any elucidation of the real matter in question is concerned. This matter, it may be necessary to explain, is not whether members of the investigating committee have been bribed to shut their eyes to the facts, or whether the newspaper correspondents have been guilty of criminal libel, but whether the papier-maché ceiling now in place is worth the two hundred and seventy thousand dollars that it cost; and, if not, who got the difference between the amount paid for it and the true value, and through whose fault did the State make so bad a bargain. The first question could be answered by experts in six hours, and the Legislature would then have some definite basis for further action. It is certain that the papier-maché cost only a fraction of the contract-price of the ceiling. The manufacturer, Mr. Sinclair, refuses to disclose what he was paid for it, but says that it was under thirty thousand dollars, and the newspaper correspondents profess to have ascertained with certainty that the exact amount was eleven thousand, five hundred dollars. If this report, which Mr. Sinclair does not deny, is correct, we shall have two hundred and fifty-nine thousand dollars as the cost of erecting a stage and putting up the new ceiling in place of the old one, with the necessary supports for it. This may, for all we know, be a reasonable price, but any first-class builder could settle the point after reading the specification and looking at the place, and the ground would then be cleared for the inquiries into the disposition of the money, about which the world outside of politics cares very little. It seems that the drawings for the ceiling were made by an architect named Rowe, the seventh architect, if we are not mistaken, who has been employed on the building, without counting the experts who have been brought in for temporary service. This gentleman, who seems to have done his work well, and to have been entirely innocent of any connection with the subsequent financiering, received the usual treatment accorded to persons who furnish designs for public work in having his flat, carved-oak panels summarily converted into "dome-shaped" or "conical" caissons of paper pulp and plaster, cast in gelatine moulds, at the instance, so far as can be discovered, of the superintendent. As to the committee which had the matter of the construction in charge, and made the contracts for the ceiling, we believe that no member has yet been found who had even read the specification. Some of them had a general idea that they had signed a contract for "either a quartered or a carved oak ceiling," but they seem to have then dismissed the whole matter from their minds, until they discovered that the ceiling was likely to drop on their heads in bits of plaster-of-Paris. Perhaps we are too obtrusive in presenting the merits of the profession of architecture, but it certainly seems to us that the services of a man who would design the ceiling, and see that it was built as specified, for five per cent on the cost, would be cheaper than those of the combination of architects, superintendent and committee, who have spent more than a quarter of a million dollars in such a way that no one can tell where most of it has gone.

FIRE AND WATER calls attention again to the discussion which has been going on in the newspapers about the value of iron shutters in protecting buildings from the effect of conflagrations outside of them, and makes some very timely remarks on the subject. The history of the curious case in New York, where a building considered nearly fireproof was destroyed, with its contents, because the firemen found it for a long time impossible to open the iron shutters, or break through the brick roof, so as to throw water on the blazing goods inside, has been copied into nearly all the daily journals in this country, and many foreign ones, and, with their usual celerity in reasoning from the smallest possible number of facts, the newspaper theorists have decided that buildings would be better off without any shutters at all, and there is some danger that they may persuade owners of store property in some cases to refuse to use them. It ought to be needless to say that this would be a grave misfortune, and the underwriters' associations should be on their guard against the dissemination of such notions. Of course, the real object of shutters is to keep fire on the outside from entering a building, and they accomplish this object a hundred times for every time that they prevent firemen from reaching a blaze inside the building so protected. Moreover, there is no necessity for fastening iron shutters in such a way as to keep firemen from opening them from the outside. In New York, where burglars are more dreaded than fire, as there is no insurance against their ravages, outside shutters are usually firmly secured on the inside, but in Chicago, if we are not mistaken, it is the rule to arrange the shutters so that all of them can be opened from the outside, and in many places one window in each story is protected by shutters so arranged. One of the best shutters we have seen is a patented one, which fastens on the inside, with a latch hooking over a bar, in the usual way, but has on the outside a plate, connected with a small lever passing through the shutter, by which the latch can be lifted. The plate protects the small opening through which the lever passes, and is so arranged that by directing a powerful stream of water upon it, from a fire-engine or hydrant, the lever is moved, lifting the latch, and allowing the shutters to swing open, which they do under the pressure of light springs. A shutter of this sort is as safe against fire as anything that can be made, yet it can be opened in a moment from the street by the firemen, without requiring ladders, which can hardly be used if a fire is raging on the opposite side of the street, or after the flames have burst out of the lower windows of the building to be dealt with.

A USEFUL piece of apparatus has come into use in Germany in the shape of a travelling electric light. The affair is very simple: a dynamo, with an engine to drive it, is mounted on a wagon, something like that of a steam fire-engine, containing boiler, fuel-box and water-tank, complete for a night's service. A dozen or so of jointed poles, a corresponding number of arc-lamps, and a supply of wire complete the equipment, and the whole is readily drawn by a pair of horses to the place where it may be needed. On its arrival, the poles are set up where required, and stayed with wires fastened to stakes driven into the ground; the lamps are hung to them and properly connected, and the engine is set in motion. The lamps immediately kindle, giving a light nearly as bright as day over the whole neighborhood as long as it is needed. Any number of lamps, from one to fifty, may be operated from a machine of suitable power; and as they may be suspended anywhere, and are not affected by rain or wind, it would seem that the apparatus might be very useful to contractors and others who have to carry on night-work on an extensive scale.

THE Emperor of Austria has conferred a signal honor upon the noted Vienna architect, Baron von Schmidt, who was ennobled some years ago as a reward for his professional achievements, and has now been called to the Austrian House of Lords, "in testimony of the confidence and regard which the Emperor entertains toward him." The German technical journals call this the highest honor that has ever been conferred upon an architect, and it is certainly a very great one.

BUILDERS' HARDWARE.[1]—XIX.

ORDINARY MODERN DOOR-LOCKS.

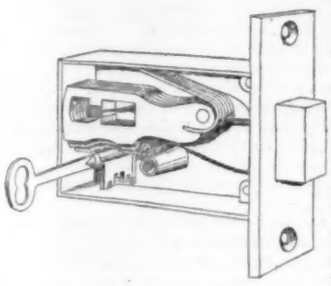


Fig. 297. Mortise Dead-lock. Russell & Erwin.

IN considering the locks at present in the market, it is manifestly impossible to even mention all of the styles and varieties, nor has it been found practicable to gather reliable data concerning all of the different makes. It is believed, however, that those illustrated will serve as fair criterions of what the market is producing. The descriptions will be limited chiefly to such as are used about an ordinary building. Time-locks, bank-locks, safe-locks, prison-locks, etc., are too complicated to come within the scope of this treatise, and are, besides, quite outside the line of what could fairly be termed builders' hardware.

An analysis of the various styles of locks can be best followed by taking the different examples according to the use to which each is put. They may, then, be classed as:

First, dead-locks.
Second, ordinary lock and latch combined.
Third, front-door locks.
Fourth, vestibule-locks.
Fifth, hotel-locks.

Any of these, except the first, may have anti-friction strikes, and may be mortise, rim, or rebate, and all can be master-keyed. Consequently in these five categories can be included all ordinary house-locks.

DEAD-LOCKS.

Figure 297 is a type of the most simple form of dead-lock, manufactured by Russell & Erwin, having five plain, pivoted levers, permitting of 120 changes in the lock by transposition of the levers. The same style of lock is made with as few as one lever. A. G. Newman manufactures a very good store-door lock, Figure 298, in which the levers slide up and down but are not pivoted together. Figure 299 illustrates the "Standard" store-door lock, manufactured by the Yale & Towne

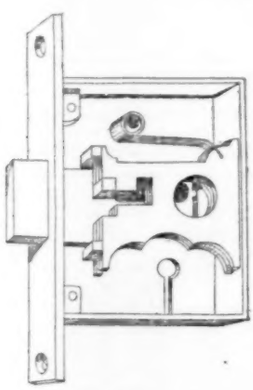


Fig. 298.

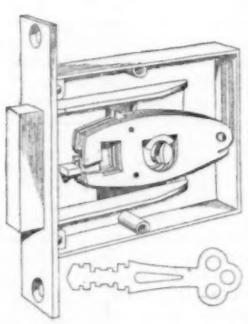


Fig. 299.

Mortise Dead-lock. A. G. Newman.

Mfg. Co., a very strong, well-made, and almost unpickable lock. The bolt-tail is the full thickness of the bolt but is made with a shell so that the tumblers work within the bolt, as it were, and the key, instead of acting against the under side of the four levers, works through the centres; and, instead of acting directly upon the bolt, simply rotates an irregularly-shaped cam. The side figure showing the bolt and the cam alone, will illustrate how this lock works. The levers in this example are of steel, as in all the "Standard" locks.

Neither of the foregoing offers any special protection against picking, except such as results from careful fitting, or, in the Standard lock, from the difficulty of reaching the levers through a small key-hole. Figure 300 shows a "Robinson" store-lock, in which the inside of the bolt-post is cut with a square notch. If an attempt is made to pick the lock by exerting a pressure on the bolt while the levers are raised tentatively in succession, the notch in the post will catch in corresponding notches on the edges of the lever gatings, holding the levers so they cannot be moved in either direction. Two of the levers only are so notched, the uppermost lever having plain gatings to prevent the posts from catching when the proper key is used. This is a hand-made lock, with all the works made of brass except the bolt-post.

Figure 301 shows another "Robinson" lock in which the post and gatings are notched in the same manner as the preceding example, but in which additional security is obtained

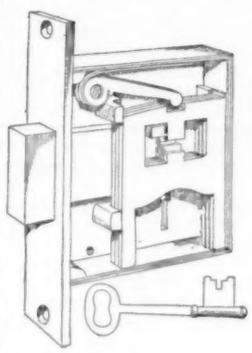


Fig. 300.

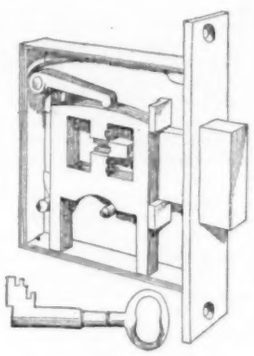


Fig. 301.

Store Locks. E. Robinson.

by attaching the post to a thin plate, sliding up and down in the bolt-tail, but held down by a spring lever such as those which work against the main levers. The post and the gatings are so arranged that if the levers could be so lifted as to bring the gatings exactly in a line, the bolt could not be moved, as the post would be too low down to pass. The post, as well as the levers, has to be raised, and on account of the notches, which prevent any tentative picking, this can be done only by the proper key. The works of this lock are all of brass, except the sliding parts of the bolt and the bolt-post which are of steel. The key is tubular, and the lock can be opened from one side only. It is an old style, and is little used at present.

A lock which is asserted to be absolutely proof against picking, is the "Dietz" lock, Figure 302. In this the locking-levers are not touched at all by the key, being separated from the key-hole by a curtain or partition on the bolt-tail, so that no wire or picking instrument can reach the levers through the key-hole. There are two sets of levers, exactly corresponding in thickness and bearing against each other only at the shoulders, as shown by the figure. The key-bits first lift the primary-levers, which are fitted with the stronger springs. The springs of the secondary or locking-levers then force the latter down in proportion as the primary-levers are raised. The secondary-levers are so arranged that the gatings are above the line of the lock-post, rather than below it as in ordinary locks, and it is evident that by raising the primary-levers to the proper heights the gatings of the secondary-levers can be brought exactly in line to permit the bolt-post to pass. But to prevent picking by the tentative process, one of the secondary-levers is made with plain gatings but the others are finely notched to correspond with notches on the post, so that if any attempt is made to force the bolt, the levers become fixed. The bolt is moved by a key-cam similar to that shown by Figure 299. The small slide at the bottom of the lock is simply to prevent the cam from turning too far. The "Dietz" lock is machine-made, but is first class in every respect, with all-brass inside works. The agents maintain that this lock never has been picked. The description may seem complicated, but the lock is very simple in action, and it is one of the most satisfactory of its kind in the market.

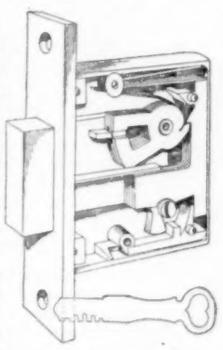


Fig. 302.
Store Lock. A. E. Dietz.

[To be continued.]

[1] Continued from page 64, No. 685.

ARCHITECTURAL SHADES AND SHADOWS.[1]

INTRODUCTORY NOTE BY PROF. W. R. WARE.

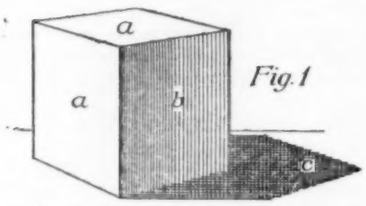


Fig. 1

a a, Faces in Light: *b*, Face in Shade: *c*, Shadow.

It is a number of years since I promised the editors of the *American Architect and Building News* that I would put in shape for publication in these columns some notes upon shades and shadows which I was in the habit of giving to my pupils. This promise I have constantly found myself unable to fulfil, and, not to keep them longer waiting, I have now, with their cordial consent, handed over my memoranda to my friend and former pupil, now my assistant and coadjutor, whose name stands at the head of this paper. In his hands the subject has been greatly developed, many new topics have been added, and the whole has been enriched by an amplitude of examples and illustrations, which makes the work as it stands mainly his own.

The ideas upon which we have worked are so simple and obvious that it seems strange that they have not long ago been fully developed. But, though their application to some special problems — as, for example, to that of the *torus* — is sufficiently familiar, especially to the students of the Ecole des Beaux-Arts, I believe that no attempt has hitherto been made to frame them into a consecutive system, and to carry to its logical conclusion the methods which those examples exemplify.

It is an obvious commonplace that almost all architectural forms and features are composed of geometrical elements — cylinders, cones, spheres, cubes and parallopipedons, circles, octagons, and squares. In architectural drawings, moreover, the light is generally taken in a definite and uniform direction, that of one of the diagonals of a cube, and the surfaces upon which the shadows fall are generally plane surfaces, vertical or horizontal. It is plain, then, that if we ascertain, once for all, the shape of the shadows of these common geometrical figures when cast upon vertical or horizontal planes by rays of light falling at the customary angle, we shall have solved, once for all, the chief part of the problems of architectural sciography.

In pursuance of this idea, it is the plan of these papers to take up each of these geometrical figures, one after the other, and ascertain the shape of its shadow under these conditions, pointing out not only the geometrical considerations which determine its form, but the geometrical characteristics of the figure thus obtained, and the most direct method of describing it. At the same time, the shape of the *shade*, or the figure presented by the dark side of the object which casts the shadow, will be similarly investigated. Finally, it will appear that the methods pursued and the results obtained are applicable to other problems in which the conditions are somewhat less simple.

These results will be embodied in a series of formulas, or maxims for daily use, and their practical application will be exhibited in a series of strictly architectural problems, some of which will be solved in the text, by way of illustration; others will be left to the skill and patience of the reader.

It is assumed that the reader is acquainted with the elements of plane and solid geometry and of orthographic projections. Whenever it is necessary to recall them to memory, they also will be stated in the form of maxims without demonstration.

CHAPTER I. — LIGHT.

Light, direct and indirect, natural and artificial; shade and shadow; reflected light, reflected shadows, diffused light; conventional and pictorial representation; the third dimension indicated by shades and shadows; luminosity modified by color, texture, angle of incidence, contrast, and aërial perspective; maxims.

1. Light is called *direct* or *indirect* according as it proceeds from its source directly to the illuminating object, or indirectly by reflection from other objects. It is called *natural* light when it proceeds from the sun; all light of terrestrial origin, however produced, is called *artificial*. The rays which reach the earth from the sun or from any other celestial body are practically parallel, owing to the immense distance of their source. Rays of artificial light, on the other hand, radiate in every direction from their source, and the shadows cast by these divergent rays not only vary in size with every change in distance from the source of light, but are different in form from those cast by the parallel rays of natural light. The great distance of the sun also prevents those variations in the intensity of light due to differences of relative distance from the illuminated objects, which, characterize artificial light.

These papers will treat only the shades and shadows cast by natural light, as the architectural draughtsman rarely, if ever, has to occupy himself with those produced by artificial light.

2. A surface is said to be *in light* when direct light falls upon it; *in shade* when it is turned away from the light. It is *in shadow* when the light is excluded from it only by the interposition of some other object. A surface in shadow is, therefore, always a surface turned *towards* the light; hence shadows can be cast only upon illuminated surfaces; that is to say, a shadow cannot fall upon a surface in shade, nor upon a surface already in shadow, except as it may be cast by a secondary or reflected light. These surfaces are often spoken of as "the light," "the shade," and "the shadow," respectively. The line which divides the light from the shade is called the dividing line of light and shade, or simply the *line of shade*. The outline of the shadow cast upon any surface is called the *line of shadow*.

3. Shade and shadow do not imply the utter exclusion of light; the darkness of the surfaces they cover is mitigated by indirect light reflected from a multitude of objects: from the earth, the clouds, buildings and trees, and from the particles of the atmosphere itself. These reflect rays of light in every possible direction, softening the shadows and lighting up corners otherwise as dark as midnight. Such light, made up of indirect rays, is called *diffused light*. Sometimes the rays from some one general direction predominate, as in the light from above on a cloudy day, or from below by reflection from a marble pavement or smooth sand, or from the side opposite the sun by reflection from vertical walls. In such cases the reflected light is sometimes strong enough not only faintly to illuminate those shaded surfaces presented most directly to its rays, but even to cast secondary shadows across them; while the shaded surfaces which are turned away from these reflected rays, and which, therefore, do not receive this subdued illumination, preserve their original intensity of darkness. This phenomenon, which may easily be verified by observation, is made use of by architectural draughtsmen to bring out architectural relief and detail otherwise lost in shadow. It is these diffused and reflected lights alone that render visible objects lying in shadow or shade: without it all shades and shadows would become mere areas of inky blackness, like the dark side of the moon. In architectural drawing, the precision and intensity of these *reflected shadows*, as they are called, are generally exaggerated, the direction of the predominant rays being assumed at such an angle as will most strikingly bring out the forms; *i. e.*, backwards and upwards to the left, as if coming mainly from the ground and from vertical walls opposite the sun. Vertical walls on the other side, being, of course, in shade, would cast no reflected light. Plate I, No. 1, illustrates this practice.

4. The object of architectural drawing being to render clear and intelligible the forms of a design, rather than to present a realistic picture, such exaggeration is perfectly legitimate. In the same way, nearly all the phenomena relating to the intensity, as well as to the direction of the ray of light itself, are treated in a precise and conventional manner, in accordance with the conventional character of all representation by elevations, sections, and plans. This may be seen by referring again to the cornice in Plate I, No. 1. In No. 3 the same cornice is drawn from actual observation which, in No. 1, is drawn according to the conventional method. In diffused light, as on the north side of a building, or on a cloudy day, the same cornice would appear as in No. 2, in which light from overhead predominates, while the reflected light is very feeble, owing to the absence of any direct light to be reflected. Reflected shadows are, therefore, wholly wanting.

5. The contrast between No. 1 and No. 2 illustrates the difference between the phenomena of direct and of diffused light, and thereby also makes clear one of the differences between architectural and pictorial drawing. The painter of figures or of still-life prefers the soft effects and delicate gradations of diffused light, as being better adapted to bring out subtile differences of texture or modelling. The works of the architect, on the other hand, stand in the full glow of the open heavens, with forms vigorous and precise, strongly relieved by deep shadows. The accessories introduced into such drawings, also, whether sculpture and carvings on the building itself, or figures, trees, or landscape in the foreground and background, are treated in a similar spirit, with broad, flat surfaces of light and shade.

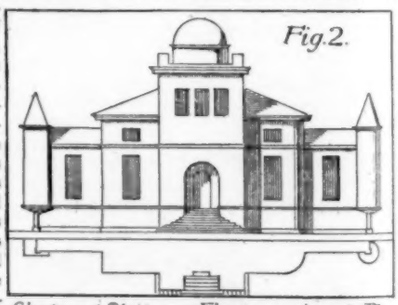


Fig. 2.

Shades and Shadows on Elevation indicate the Plan.

6. Moreover as the shape of the shade depends entirely upon the form of the illuminated body, and the shape of the shadow depends partly upon that and partly upon the form of the surface on which the shadow falls, it follows that the shade and the shadow must be carefully delineated in order that they may give precise information as to the real form of the surfaces in question. This is, indeed, perhaps the chief reason for representing them at all in architectural drawings, the artistic considerations involved being of secondary

[1] By A. D. F. Hamlin, Instructor in Architecture in the School of Mines, Columbia College.

importance. The elevation, for instance, can show only two of the dimensions of a building, its height and breadth. But if the shadows are put in, we can judge of the third dimension or depth of its various parts almost as accurately as if a plan were given, while the representation is far more vivid and attractive. In Figure 2 the shades and shadows convey a livelier idea of the true form of the building shown than an elevation without shadows, even accompanied by a plan, could convey.

7. Surfaces exposed to the divergent rays of artificial light, are, as has been said, less brilliantly illuminated in proportion to the square of their distance from its source. But though this cannot happen with the parallel rays of sunlight — (all terrestrial objects being virtually at the same distance from the sun), there are a number of other reasons why surfaces exposed to direct light are not represented as all equally brilliant. The degree of their luminosity is affected by the color and texture of the surfaces themselves, and by the angle at which the light falls on them. The darkness of surfaces in shade is affected by their exposure to reflected light, by the contrasted luminosity of the surfaces near them, and by their remoteness from the spectator.

8. *Color.* — It is hardly necessary to say in the first place, that dark-colored objects are naturally represented as less luminous than light-colored or white ones. It is worth while, however, to point out that, especially when drawings are made in black and white, this consideration is often disregarded, brick, stone, marble and wood being all represented as of the same "value."[1]

9. *Texture.* — Rough objects appear darker than smooth ones, the little eminences into which their surfaces are broken up having each a minute shade and shadow of its own, the magnitude of which depends upon the steepness of its sides and the angle of incidence of the light (Figure 3).

10. *Angle of Incidence.* — Surfaces turned fully towards the light are more brilliantly illuminated than those on which the sun shines obliquely. But it is only on rough surfaces that, through the multiplication of minute shades and shadows, as above explained, this difference is at all noticeable. The light upon a smooth column of marble, or even of sandstone, exposed to the noonday sun, appears of nearly uniform intensity, so that the curved surface looks almost flat. As the shade upon the dark side of the column, lighted only by reflected light, is also of nearly uniform intensity, it follows that whereas in-doors, where it is exposed to diffused light alone, a column or other cylindrical surface passes gradually from the highest light on one side to the deepest shade on the other, a column in sunlight shows one side light and one side dark, the light and shade meeting abruptly at the line of shade. Both are apparently flat, and the column, except for the shadows of base and cap, looks nearly square with a slightly rounded corner, instead of cylindrical (Plate I, No. 5). To avoid this effect it is customary in architectural drawings, especially those drawn to a large scale, to tone down the lights towards the line of shade, as if the stone were rough or the sun declining (Plate I, No. 4). But this should be done with moderation, and not at all when the scale of the drawing is small as in No. 5.[2]

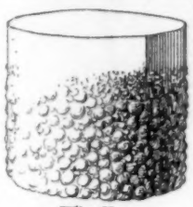


Fig.3

11. *Contrast.* — Where two surfaces of different luminosity meet, the lighter one appears by an optical illusion to be lighter and the darker one darker, along the line of contact; and, curiously enough, this is the more marked the less intense is the illumination. In a polygonal prism for example, especially if the light to which it is exposed is not very strong, each face will seem darker along the edge nearest the light and lighter on the other, than it really is, making it appear concave instead of flat (Plate I, No. 6). This is often witnessed upon octagonal chimneys, especially towards sunset. This illusion serves to heighten that mentioned in the previous section. The shade upon a round column enhances the apparent luminosity of the light side just where the diminution in the angle of the light tends to impair it, making the light side look quite flat. At the same time the light, by contrast, enhances the apparent depth of the shade where they come together, so that the line of shade forms an abrupt boundary between them (Plate I, No. 5).

12. *Distance.* — Finally, it is to be observed, that the apparent intensities of lights, shades, and colors, are alike affected by distance. This is what is called "Aerial Perspective," and is due partly to the imperfect transparency of the air, partly to the different apparent scale upon which objects at different distances are presented. This phenomenon, which is conspicuous enough out of doors, may even be detected across a room.[3] It is customary in architectural drawings somewhat to exaggerate this effect, making the more remote parts of buildings less vigorous in light and shade, as well as in color, than those nearer the eye (See Plate I, No. 7).

13. From these considerations it follows that:

First. The shade upon an object is not so dark as the shadow which it casts, since the surface in shade is, in general, turned towards the reflected light, and the surface in shadow is turned away from the reflected light and towards the shaded surface, so that it is doubly dark (See Figure 1).

Second. The line of shade is the darkest part of the surface, since it is exposed neither to the rays of direct light, like the light side, nor to those of reflected light like the dark side, both sets of rays being tangent to it. Moreover, it looks even darker than it is through the effect of contrast, as has been already pointed out. This phenomenon is often very conspicuous in nature, pebbles on a white road looking sometimes in the strong light reflected upward, as if a black thread were tied around them. (Figure 4). Even in the diffused light of a room the line of shade upon rounded surfaces is often conspicuously dark (Figure 5).

Fig.4.

Third. Surfaces in shade or in shadow are seldom perfectly flat in tone, some parts appearing lighter or darker than others by contrast with the surfaces next them, or being really lighter in one part than another, because more exposed to reflected light or nearer to it. For reflected light being of terrestrial origin is divergent, and more powerful near its source than at a distance.

Fig5

Line of Shade in diffused Light.

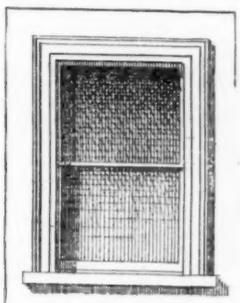


Fig. 6.

It is customary, therefore, in architectural drawings to make shades and shadows darkest next the sky, by contrast, and lighter as they approach the ground, from which the chief reflected lights are supposed to come; to make the small and narrow shades and shadows darker than the large ones; and to make the large ones darker on one edge than on the other. Window-openings and doorways are made darkest at the top as if modified by reflected light from the floors (Figure 6); but in arcades and archways the shadows are sometimes made darkest below, in recognition of the effect either of contrast with the sunlight below, or of a diffused light, doubly reflected, from the ceiling above (Figure 7). When an opening occurs within another opening, the two are generally graded in opposite directions (Figure 8, and Plate I, No. 7).

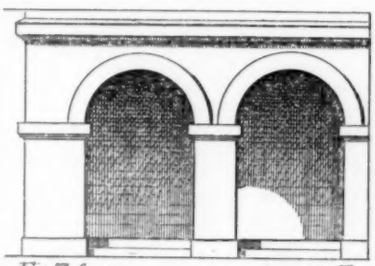


Fig. 7. Arcades usually tinted darkest at the Top.

Fig.8. Arch & Doorway.

Fourth. When a cast shadow extends to the edge of the body on which it falls and consequently across and beyond its line of shade, it meets and coalesces with the shade as in Figure 9. In this case the

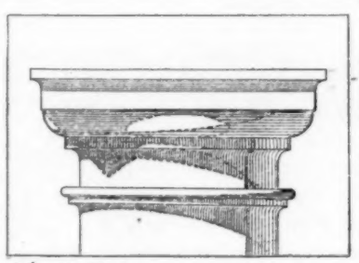


Fig. 9. Shadows cast across Shades. Shades and Shadows coalesce.

[1] Even in pictorial draughtsmanship this is often the case, as may be witnessed daily in wood-cuts and engravings, in many of which the local color of objects is entirely disregarded. Indeed, even in paintings, different artists and schools of art differ in nothing more than in the degree of importance they attach to the faithful representation of the relative amount of light reflected from different surfaces, or, as it is termed, to the "preservation of the values."

[2] A curious illustration of this fact is presented by the moon, which ordinarily is seen in the full glow of the sunlight upon it and looks absolutely flat. When, however, the edge of the earth's shadow falls upon it in an eclipse, in the consequent diminution of its illumination it appears perfectly gobular — a reddish ball instead of the customary brilliant disc.

[3] The lights and shades in a room are so confused that it is always difficult to identify correctly the cause of every gradation of light and dark, and to distinguish between the effects of aerial perspective and those of diminished illumination.

line of shade, though obscured, exists as the line of division between the shade and the shadow, that side of the object turned towards the light being in shadow, and that turned away from it in shade. If in a drawing the shade is made lighter than the shadow, as in Figure 10, the line of shade reasserts itself and becomes again visible. As a matter of fact, however, there can be no such sudden change of intensity from shadow to shade except on adjacent surfaces meeting at an angle, for only by such abrupt change of direction can one of two adjacent portions of surface be exposed to reflected light and the other wholly deprived of it. In Figure 10 along the line of shade from *a* to *b* there is no such abrupt change of direction in the surface as would expose the shade to strong reflected light while wholly excluding the latter from the adjacent shadow. The change of luminosity would be gradual as in Figure 9, and the line of shade would exist as a mathematical and theoretic boundary between the shadow of the abacus and the shade of the echinus.

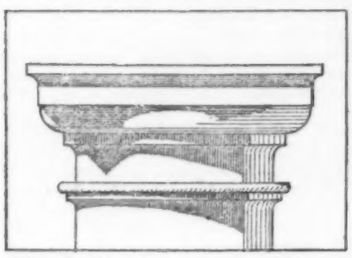


Fig. 10. Shadows cast across Shades. Shades distinguished from Shadows by lighter Tint.

14. Summing up the considerations thus far adduced, we may state their results in the form of maxims, as follows:

I. Surfaces in shade are turned away from the light, surfaces in shadow are turned towards it. Consequently,

II. No shadow can be cast upon a surface in shade, nor upon a surface already in shadow except by reflected or artificial light.

III. None but illuminated bodies can cast shadows.

IV. Those shadows are darkest that fall on the brightest side of an object, and small shadows near large lights seem by contrast darker than large shadows near small lights. (See shadow of cap on octagonal pier, Plate I, No. 6.)

V. Shades and shadows are darkest near the edges adjacent to the light; they are lightest in those portions most exposed to reflected light, that is, those most turned away from the sun.

VI. Shadows are darker than the adjacent shades. The lightest shades (that is, those most affected by reflected light) are darker than the feeblest lights.

Maxim II is not infrequently violated, one shadow being represented as crossing another although cast by the same light, as in Figure 11. The error is manifest when we reflect that a surface already in shadow cannot be further darkened except by the exclusion of reflected, diffused, or artificial light which would otherwise reach it. Sometimes one also sees the absurdity committed of representing an *unilluminated* object as casting a shadow, as at *a*, Figure 11, which is evidently impossible, and contrary to the principle of Maxim III.

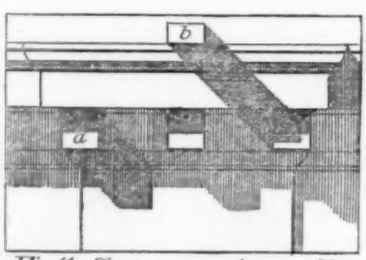


Fig. 11. Shadows incorrectly crossing Shadows

15. Plate I, No. 8, is from a photograph of a plaster cast in full sunlight. The intensity of the high lights where the solar rays are normal to the lighted surface; the delicate gradations of half-light near the lines of shade on the minutely-roughened surface of the fruit; the darkness of the line of shade; the intensity of the cast shadows, especially where contrasted with adjacent high lights and in recesses where no reflected light can penetrate; the generally darker tone of the shadows as compared with the shades, and the brilliancy of some of the reflected lights cast back into the shades, excellently illustrate the principles just set forth, and prove their foundation on the facts of nature.

[To be continued.]

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSE OF MRS. ELDRIDGE, OCHRE POINT, NEWPORT, R. I. MR. DUDLEY NEWTON, ARCHITECT, NEWPORT, R. I.

[Gelatine print, issued only with the Imperial Edition.]

ARCHITECTURAL SHADES AND SHADOWS, PLATE I.

See article elsewhere in this issue.

CHURCH, ANN ARBOR, MICH. MR. W. G. MALCOMSON, ARCHITECT, DETROIT, MICH.

THIS plate exhibits the accepted design for a church building now in course of construction, under the auspices of the National Christian Woman's Board of Missions. Exterior shows roughly-squared boulder stone. Interior finish is oak and ash, natural. Estimated cost about $20,000.

DESIGN FOR THE PROPOSED MUNICIPAL BUILDING, WASHINGTON, D. C. PREPARED BY MR. W. J. POLK.

COTTAGE AT WATCH-HILL, R. I. MR. HOWARD HOPPIN, ARCHITECT, PROVIDENCE, R. I.

PROBATE COURT AND REGISTRY OF DEEDS, EAST CAMBRIDGE, MASS. MESSRS. WAIT & CUTTER, ARCHITECTS, BOSTON, MASS.

EARTHQUAKES.—I.

View at Vera Cruz, Mexico.

FATHER IGNAZIO GALLI, director of the astronomical observatory at Velletrie, near Rome, has just published a long and very detailed memoir on earthquakes, which casts an unexpected light upon a momentous scientific problem. Father Galli is a *savant*, very conscientious and perspicacious — one who for several years has applied himself to the fathoming of the phenomena of aerial electricity, as well as of those which are connected with terrestrial convulsions. I have the honor of knowing him personally, and I have had occasion in several conversations to notice the spirit of research, observation and critical power with which he is animated, and without which science reaches only chimerical conclusions. He is one of those churchmen who do not believe that the brutalities and mysteries of nature are at enmity with the respect which we owe to the divine being. He thinks, on the contrary, that every scientific advance enlarges the limit of human knowledge and increases the sum of lawful well-being, and the security which man enjoys in harmony with the views of Providence such as the Christian society conceives.

The work which he offers to the meditation of the world of scientists consequently deserves to be taken into serious consideration, and although consecrated to the examination of certain meteorologic and telluric phenomena, it interests in a very different way architects and engineers; for it furnishes very exact and useful indications as to the best means of protecting structures against damage by earthquake.

One of the most interesting parts of the book before us is that where the author recounts the history of the different beliefs and theories which have been current on this subject. All true *savants* have always believed that the earthquake proceeds and propagates itself by the vibration of the soil. In ancient times they had stranger notions. Pliny believed that earthquakes were a consequence of the explosion of thunderbolts in the interior of the globe. Aristotle attributed them to dry exhalations from the soil, which produced, according to him, not only these convulsions, but thunder and wind. Averroes, in speaking of the terrible earthquake which desolated the Province of Cordova, his native country, in 1139 (566 of the Hegira), mentions a plant called the "earthquake plant," and in so doing informs us that at this time they believed that the upheavals and rending of the soil had the property of giving birth to a special flower. This points without doubt, in the case of Averroes, to seeds borne from neighboring islands, perhaps the Azores, by the furious winds which ordinarily accompany this kind of phenomena; and as these seeds found the soil deeply disturbed by the violent vibrations, they prospered there rapidly, and offered to the eyes of the astonished inhabitants the fruit of an unexpected vegetation.

The invention of powder gave an unexpected appearance of truth to Pliny's theory. The effect which the explosion of mines produced made people believe that the entrails of the earth contained

deposits of sulphur and nitrous matter which the sun's heat or subterranean fires suddenly lighted, thus producing formidable explosions. They began to believe in consequence that there existed some connection between volcanoes and earthquakes, and then to the supposed action of sulphur and nitre was added that of bitumen and vitriol.

Descartes thought that the mechanical action of these hypothetical explosions proceeded from the infiltration of sea-water into the subterranean cavities, and this supposition was rejuvenated in 1884, at the time when an earthquake ravaged the south of Spain. Only a more profound study of the question has allowed us to doubt the credibility of this theory, and especially because of the enormous extent of territory sometimes affected by an earthquake.

Stukeley, in 1750, calculated that in order to shake up a zone having an extent of 300 miles, the explosion must be produced at a depth of at least 200 miles. Now no explosion could lift up a cone of this proportion, even if it were possible to accumulate at the central point of upheaval all the powder manufactured since its invention. Here are the figures: the English mile being 1609 metres. By taking a base of three as the mean specific weight of the rocky layer, we have in round figures a total weight of 60,000,000,000,000,000 kilogrammes. The force necessary to raise through even ten centimetres such a mass as this would be 6,000,000,000,000,000,000 kilogrammetres.

Toward the end of the last century superstition took another direction, which gradually acquired a certain resemblance to Pliny's theory. This was the time when everybody was speaking of the electric-fluid, the electric-spark and electric-explosions. Franklin's experiments were decisive, and by bringing the lightning into captivity the grand American *savant* proved that it was only the result of the condensation of fluid. From this they passed on to a belief in the incessant discharge of electric-currents between the clouds and the earth, and to the idea, very analogous to that of Pliny's, that earthquakes were only the physical consequences of internal explosions. Father Beccaria published in 1783 a very long memoir for the sake of developing this theory, which was, nevertheless, refuted by Galvani and Volta. The first admitted, at most, that the electrical whirlwinds resulting from earthquakes could strictly be the cause of certain troubles which had been observed amongst animals. As to Volta, he revolted energetically against those too generalizing minds, who, since the discovery of Franklin, explained all the hitherto unexplained phenomena of nature as being due to electricity. This momentary aberration led astray for a time the investigations of the *savants*, but little by little studies and geological discoveries brought back the attention of physicists to the mechanical process, and especially to the vibratory form of the tremblings of the earth. Before long people felt sure that at a depth of forty to fifty kilometres none of the known bodies could exist in a solid state and that the fluid mass which formed almost the whole of the terrestrial sphere must constantly be modifying its shape under the intermittent and periodical action of the moon and sun, as can be seen in the liquid masses which flow on the surface of the globe. Here we are, then, in the presence of the hypothesis according to which earthquakes are only the consequence of the shaking of the incandescent seas which are constantly in agitation under the crust of the globe. This theory, to-day almost entirely abandoned, had the advantage of fixing the investigations of certain physicists upon the nature of these shocks, and of creating a suspicion of a vibratory principle in their propagation. According to Humboldt, this principle had been suggested, in the first place, by the studies of Thomas Young on the analogy between the vibratory movement of solid bodies and that of the sound waves of the air. What is indisputable is that the theory of the vibrations of the ground was formulated categorically in 1830 by Father Pianciani. Robert Mallett and William Hopkins gave to this theory synthetic precision, and Wertheim distinguished the vibrations and waves into longitudinal and transverse. Once this point reached, the author defines with preciseness the thesis which he proposes to uphold, and which must be the proper one. What has been called, up to the present time, the movements of mass, or to word it better, the perpendicular upheavals, apropos of earthquakes do not exist. It may happen that the nature of the ground can give to the vibratory wave a concentric and saltatory form, but the general character of the phenomenon is undulatory and vibratory, and grows gradually weaker as it advances. Proof is that almost always the earthquake is superficial and does not penetrate the upper crust. Berzolius informs us that in 1823 the miners who worked in the mines of Persberg and Falhun had not the slightest knowledge of the earthquake which desolated the whole country above their heads. In 1828 the Rhenish provinces were ravaged by an analagous disaster, and the miners at Mulheim and at Unn heard no sound of it. On the 17th of March, 1872, the southeastern portion of California, notably the mineral deposits at Long Pine, was devastated in its turn. The little town which was springing into being at that place was entirely destroyed, except the wooden houses. More than a hundred shocks were counted, and yet the miners at work in the shafts had no knowledge of even one of them. The same was the case with the earthquake which took place in Virginia, in 1879. One which more recently caused some destruction in the same city was hardly perceived by the miners who were in the upper galleries. Those in the lower drifts heard no noise.

At Cesena, in Roumania, at the end of an earthquake shock the population hurried in a body to the pit-shaft, believing that there had been an explosion below, and astonishment was boundless when at the usual hour the miners were seen coming to the surface unhurt, much surprised in their turn at the solicitude with which they were welcomed. They had heard nothing.

In the evening of December 30, 1883, so violent was the shock that shook the city of Dorignier, near Douai, in France, that the frightened inhabitants precipitately abandoned their houses. Here the miners at work in the pits heard only a subdued rumbling, but did not perceive the least motion of the earth. M. Domeyka, Engineering General of the mines of Chili, reported to the Academy of Sciences that once on leaving the pit-shaft he found his own house thrown to the ground by an earthquake, of which, beneath the surface, he had had no indication. He added, that according to tradition, the miners believed themselves safer against earthquake shocks when they were below ground, than when they were upon its surface.

Such citations could be multiplied without stint, and would demonstrate to the farthest limit the proof that, at a depth of a few metres, the oscillation of the ground does not take place, and that between the superficial crust, where the vibrations are transmitted, and the lower strata, where the phenomenon is absolutely imperceptible, there is an intermediate layer, where it is only sensible in an acoustic form.

Finally, all the observations bearing upon this subject have equally established that earthquakes are propagated really in the form of undulations of the ground. At Albano, for instance, the inhabitants of that country were perfectly familiar, in 1829, with this phenomenon, which, for a certain length of time, was reproduced in their midst with an undesirable frequency. They saw from afar plants and trees tottering, bowing themselves and rising up again, as do the masts of ships which float upon the sea, and they stopped in the midst of their tasks in order that the undulation, of which they had had this warning, might pass on its way. A soldier, a friend of the author, told him that in 1879 he was sitting, one May evening, in the open field, and all of a sudden he felt himself lifted up and saw the ground in front of him taking the form of a receding wave-crest. Finally, in his admirable work on volcanoes and earthquakes, M. K. Fuchs describes with great minuteness these undulatory movements of the ground. The surface seems to rise up and fall back with regularity, while the movement is propagated in a determinate direction. During the severe shocks the earth seems to have lost its solidity, and resembles a moving liquid. An undulatory movement does not make itself felt merely as if the observer were in a boat, but sometimes the movement of the ground can actually be seen.

The still superficial ideas which obtained regarding the transmissibility of geological bodies seem to refute this manner of explaining earthquakes; but Father Galli quotes a very plausible example for establishing this transmissibility: If an observer takes his place at some distance from the spot where pile-driving is going on, he receives through the soles of his feet a very sensible impression every time that the hammer falls, and the intensity of this impression augments or diminishes according as he removes farther from or approaches nearer to the point of percussion. Is not this a clear proof that the soil serves as conductor for circular vibrations which diminish in force as the circumference of vibration enlarges? The same Fuchs, besides this, assures us that the transmission of the undulatory movement is sometimes very easily seen, especially in the matter of trees. Dolomieu reports that he saw, in 1783, during an earthquake in Calabria, trees bowing themselves so greatly when an undulation passed under them that their summits touched the ground. The same observation was made during an earthquake in Missouri in 1811, when the trees first bent themselves, as I have just said, and then raised themselves erect at each passage of an undulation. This interpretation would explain in a certain manner certain secondary phenomena which up to the present have remained obscure, such as the projection of a solid body to a distance during these earthquakes; crevices opening in the ground, and so completely closing up after the shock that, for example, a hen was found that had her claw caught in a crevice in the pavement after the disaster at Melfi in 1851; and, in the last place, the cloud of dust which accompanies earthquakes, and which, in a country where the land is dry and sandy, is only a consequence of strong vibrations of the ground. In Provence and Liguria, during the terrible calamity of 1887, there was clearly distinguished on the beach, and in those places where the sand is fine, such a cloud, which formed itself and then the scattered sand drifted into the air.

During the earthquake which devastated Liguria in 1887, there was also established a peculiarity worthy of the greatest attention. We know that in this province, planted with olive vineyards, there are a great number of slate cisterns of considerable depth, which serve as receptacles for the oil after the harvest. At the time when this catastrophe took place these cisterns were all full, since the harvest was but just finished. Now, not one of these spilled over, and not one of them received the slightest injury, although the water-wells were all damaged, and their waters spoiled. Even in villages which were almost entirely destroyed, these oil-cisterns were found absolutely unharmed. What, then, is the explanation of these surprising phenomena?—The difference of vibratory conductibility which exists between oil and water, and the almost absolute incapacity of the first of these substances to transmit a shock. The experiment made on this head by Father Galli, and which everybody can repeat, is a very clear demonstration. If, by the aid of a fiddle-

bow, we cause to vibrate a finger-glass filled with oil, we observe the surface of the liquid is agitated by the merest shivering. It is the same with a glass containing water covered with a film of oil. The oil presents no perceptible agitation, while pure water shudders and is disturbed, and is covered with miniature waves so long as the vibration continues. The oil, then, remains non-conducting, even when it only forms an exceedingly thin layer; and this phenemenon is very closely related to that which is produced during a storm at sea, when a certain quantity of oil is thrown upon the water. Now it is certain that the thing which saved these oil-cisterns in Liguria is the vibratory form of the shocks, for if the movement of the ground had been concentric or upheaving the bottom of the cistern would have been raised, and the liquid, overcoming the resistance of the covers, would inevitably have been spilled. H. Mereu.

[To be continued.]

BOOKS AND PAPERS.

It would seem as though there were no room in the æsthetic and literary world for another history of art, and, in a certain sense there is certainly no very crying need for many more such works as Lübke and von Reber have given to artists; still, a very tangible evidence that the lists are not yet full is afforded by William Henry Goodyear's recent "*History of Art*,"[1] a work which would seem to be more fittingly designated by the humbler title of "hand-book," as, in the three hundred pages of the volume the leading points are only touched upon. The author's familiarity with art is unquestionable, and in the distinct lines of both architecture and painting he is well-known as a writer and critic, while a long experience in connection with the Metropolitan Museum of Art is proof of his artistic appreciation. Such a work as this will then be welcomed by every one who feels the need of a concise presentation of facts in the history of art, made by one who confines himself to such statements as are indisputable, without undertaking any elaboration of details. The pages are divided pretty evenly between the arts, one-third of the book being given to architecture and about eighty pages to sculpture.

As would very naturally be expected, many of the architectural distinctions of style are lost sight of, or at least they do not seem to be preserved with the care one might wish, though the writer hits off very justly the lack of style in our modern work when he says that many or most of our buildings do not belong to any style at all, unless it be one of which we, as moderns, are unconscious. In treating the subject, a radical departure has been made from the order usually followed by writers upon the history of architecture, the modern work being considered first in considerable detail; and it is a change which subsequent writers may follow to advantage. We naturally draw our first ideas of architecture from the examples about us, and it is really only after a long training in art that one can rightly appreciate such monuments as the Egyptian pyramids or the Assyrian brick palaces. In fact, analysis is, to most minds, more appreciable and satisfactory than synthesis, and the former process of reasoning has the advantage that it is complete as far as it goes — a point which must be kept in view when writing a book such as this, which, after all, is more properly intended for the public than for those to whom art is a profession, though the same idea could be applied to a more detailed art history. Tell a student that St. Patrick's Cathedral is of French architectural extraction and Gothic — or buttressed Gothic, as Mr. Goodyear has it — by classification; that Girard College is Corinthian and Classic; that William K. Vanderbuilt's house is Renaissance and Francis I; and if he never hears another word about architecture, these buildings will be as types to him and he will have a hundredfold more knowledge of the art than if he were to give months to an investigation of the Egyptian hypostyle halls, or an elucidation of the knotty Greek hypæthral question. This seems to be exactly the idea which the writer of this history had in view, and though elaborated only to a slight degree it is sufficient to render the study of architecture interesting from the first page.

Another noteworthy feature of the book is the illustrations, and they are noticeable quite as much for the medium employed, as for the execrable manner in which they are set forth. The two hundred and five process reproductions of photographs which illustrate the work are excellent in idea, and, granting the claim that the worst photograph has some peculiar advantages over the best engraving for the reproduction of works of art, "the illustration of the book is a successful experiment as regards the use of photography, and as regards the effort to illustrate adequately a history of art in number and choice of objects." As regards the process, it is hoped that in future editions something more satisfactory may be found. There are several other methods of reproducing photo-prints, and although it would, of course, be quite out of the question in connection with a work so modest in size and in price as this, we can imagine nothing more complete as illustrations to the history of art than a series of three or four hundred of the best gelatine prints made directly from the old works of art.

As a text-book or as a handy volume to carry to Europe with one as a guide to historic art, this book seems to be peculiarly suitable, both by reason of brevity and at the same time, its completeness; and by reason of the categorical manner in which the facts are arranged and set forth. The text is sometimes a trifle dogmatic, perhaps, and yet it well shows that the history of art is not the undefined, vaguely æsthetic study some writers would have it appear, and that the old masters have a precise historic and artistic value which is not measured by individual appreciation. "Personal taste, one's chance acquaintances and surroundings, or the fashion of the hour, are apt to be disturbing elements when we use modern work as the standard of appeal for educational purposes. In dealing with the past, we stand on firmer ground. The weight of authoritative criticism is such, and its verdicts are so well-known, that the individual instructor becomes the exponent of these and must be judged by his own rendering and appreciation of them. The learner then stands in face, not of an individual teacher, but of the criticism of art as determined by its standard authorities. To develop and form an original and independent taste is the object of the learner. To offer a firm basis for this development by the suppression of individual views and by attention to the most general principles must be the object of the teacher. On the whole the matter of fact is the main thing."

These last three sentences fitly express the scope and the intent of the book.

[1] "*A History of Art*": by William Henry Goodyear, B. A.; lately Curator in the Metropolitan Museum of Art. New York: A. S. Barnes & Co. Price, $3.50.

BUILDING LAW.

THE PROPOSED "STANDARD FORM" FOR BUILDING CONTRACTS.

We have been requested to examine the form of contract adopted by the Joint Committee of the American Institute of Architects, the Western Association of Architects and the National Association of Builders, as a "standard form," to which it is hoped that all building contracts will, in time, conform.

While the end in view, viz., the drawing of all building contracts with the same general provisions and conditions which eventually would become familiar in meaning and effect to owners, architects and builders, is a praiseworthy one, we have serious doubts as to whether any such scheme is practicable; and we are unhesitatingly of opinion that this particular attempt will not commend itself to the judgment of the building public.

The chief objection to the form in question is the extended authority given to the architect: he is made the agent of the owner; he is given authority to make alteration and order extras, and to waive the provisions as to time; he is to determine the amount of loss sustained by the owner in case of delay on the contractor's part; also, whether the contractor is in such default as to justify the owner in continuing the work on his own account, and (apparently) to pass upon the sufficiency of evidence that the premises are free from liens. He is also to "direct" the work.

The real parties to this contract would seem to be the contractor and the architect, rather than the contractor and the owner of the premises; the latter having nothing to do but to promptly pay whatever bills may be incurred by the architect, howsoever much in excess of the contract price. The architect can increase the cost of the building to any extent that he sees fit, and the owner has apparently no power to get rid of him. The contract amounts, in short, to an irrevocable power-of attorney to the architect to build such a house as he sees fit, with full power to pledge his employer's credit in payment of the bills.

We doubt if one owner in a thousand would sign a contract like this, if he fully understood its scope and meaning. There may be some special cases in which the owner is, for some reason, willing to give the architect *carte blanche* in regard to plans and cost; but, as a rule, of course, the wishes and necessities of the owner in respect to design, construction and expense, are essential conditions of the problem. Even if the owner is willing to let the architect build the house at his own discretion as to cost, it would still be unwise to clothe him with a general authority to order alterations and extras; for it must never be forgotten that the real cause of building disputes and the real question at issue between the contractor and the owner is not whether the alterations were, in fact, ordered, but whether a jury will find that they were. As the law stands to-day, before the contractor can saddle a bill for extras on the owner, he must show either that the owner himself directly ordered the work, or else that it was ordered by the architect, and that the latter had express authority to give the order. Every one who has tried building cases knows the ease with which unscrupulous contractors can, through their own evidence or that of their workmen, convince a jury that the order was given by the architect; when it comes to the second step, however, the builder's case generally fails, unless the owner did, in fact, order the extras himself, or expressly authorize the architect to do so. Under this proposed "standard form" of contract this second and most important step in the builder's case would be unnecessary; he would only have to convince the jury that the architect ordered the alterations; and the main safeguard of the owner against manufactured and fraudulent evidence would be gone.

We think, also, that this extension of the architect's authority

would be a serious annoyance and danger to him. Such a provision might, at first sight, seem convenient as permitting an architect to secure, without special consultation with his client, the execution of any work that may have been omitted from the plans and specifications. In practice, however, exactly the opposite result would be pretty sure to follow; the owner would be more indignant at the presentation after the building was done of a heavy bill for extras ordered by the architect without his knowledge, than he is now at the necessary additions to the contract price that are made known to him during the progress of the work. And, although in most cases it would be wholly unreasonable to expect that plans and specifications prepared before the work is begun should, in fact, prove coextensive with the case, and contain everything that is necessary to the completion of the building; still, it is plainly the architect's duty to make the original plans and specifications as comprehensive as he can. He is employed and paid to do that very thing; and if any omission is subsequently discovered, it is and ought to be incumbent on him to go to the owner and procure his express and special authority to make it good. The obligation to consult the owner before ordering extras is in one sense a burden to the architect, but in the end it probably gives him much less trouble than if he had the right to give orders without saying anything about them to his client. The architect should spare no time or labor in making the plans and specifications as comprehensive as he can at the outset; he should take pains to explain to the owner that in all probability there will still be some things forgotten or omitted; and, then, when such omission is discovered he should in each and every case procure the written consent of the owner to the alteration or extra. If small items have to be ordered before the owner can be reached, it should be understood that this is done subject to the owner's approval, and he should be notified at once, the architect assuming the risk until ratification by his client. This is the uniform practice in many architects' offices, and should be in all.

The proposed form of contract would prove, moreover, not only more troublesome to the architect than the existing practice, but would also be a source of pecuniary danger in a manner and to an extent that would not be apt to suggest itself to the architect, unless he has been mixed up a good deal with building litigation. Under the present practice if an owner is dissatisfied, and he often is, with the amount of the bills for extras, there is practically not much danger of the architect being held responsible. The owner cannot voluntarily pay the bills, and then sue the architect for breach of contract in ordering them; for, if the orders for extras were not given by the architect with the express sanction of the owner, the latter would not be liable to the contractor, and had no business to pay the bills. If he does not pay them the contractor brings suit, and in ninety-nine cases out of a hundred, so far as our experience goes, in fact, we might say in every instance where the owner is financially responsible, the suit is brought against him rather than against the architect. In such suit the architect is a witness as to the authority given him by his client; if it was given, he, of course, so testifies, and that generally settles the case in favor of the contractor. Judgment being rendered for the contractor and paid by the owner, the latter cannot turn round and sue the architect, for the very basis of the judgment against him in the contractor's suit was that he had given express authority to the architect to order the work. If the contractor is unsuccessful in his suit, that, of course, ends the controversy as between the architect and owner, leaving the former still open to a suit with the contractor. In this suit the contractor cannot succeed unless the architect, in fact, ordered the extras; and, if he did so without authority from his client, he has only himself to blame.

Let us see now what the course of events would be under this proposed "standard form." The contractor sues the owner for the price of extras which he claims were ordered by the architect. He is relieved from proving that the architect had any authority in fact, because the contract has made him the owner's agent for the purpose of ordering alterations and extras. He recovers a judgment for the amount of his bill and interest. The owner thereupon sues the architect for breach of some private understanding that he may have had, or claim to have had with him, to the effect that no extras should be ordered without special authority. In such an action the former judgment against the owner would be no bar to the latter's recovering from the architect the whole amount paid to the contractor, and the issue would be simply this: whether in the first place there was any such private arrangement or understanding between the architect and the owner; and secondly, if there was, whether it was adhered to by the architect. We think architects will hesitate before suggesting to their clients a form of contract which, by reason of its unusual provisions, would subject them to such risks as these.

A case in point has just been called to our attention as editor of this department. The owner of a large building which is just completed has been presented with bills for extras amounting to some twenty to thirty thousand dollars, and has refused to pay them, charging that the architect had no authority to order them. This means trouble for the architect of course; but there is practically little danger that he will be called upon to pay the bills himself, if, as we assume was the case, the owner did, in fact, authorize the alterations. The contractors will sue, and, if they lose, that is the end of the owner's case against the architect. If they win, the verdict will settle conclusively the fact that the owner *did* expressly authorize the extras. If, however, the proposed "standard form" of contract had been used, there would be little to save the architect from a law-suit at the instance of the owner, if the latter adhered to his position.

We have taken some pains to ascertain the practice of the profession in the city of Boston; also their opinion as to the desirability of enlarging the scope of the architect's authority in the manner proposed. We have been unable to find a single form of contract in use in architects' offices containing such a clause, or anything similar, and we have yet to find an architect who personally desires to assume the responsibility that such a change would throw upon him.

The great authority vested in the architect under this proposed form of contract is objectionable for another reason. If the architect is the agent of the owner, and the work is carried on under his direction as such agent, it is extremely difficult to hold the contractor to a strict compliance with the terms of his contract; the defence in every case is that the architect interfered and ordered the work done as it was done, and — the architect being the agent of the owner — the latter is bound to accept the defective work as a due performance of the contract.

A further special objection to the architect's being made the agent of the owner for any purpose at all is to be found in the operation of the Employers' Liability Act, passed by the Massachusetts Legislature in 1887. Section 4 of that act makes the owner responsible for accidents that arise from "any defect in the ways, works, machinery, or plant if they are the property of the owner," — and anything permanently attached to the building is the property of the owner — "if such defect arises, or had not been discovered or remedied, by the negligence of any person entrusted" by the owner "with the duty of seeing that they were in proper condition." The meaning of this clause has never been judicially construed; but it is obvious that if the architect is made the owner's agent to "direct" the progress of the work, any accident due to a defect in the stairways, floors, or anything else affixed to the building would form the basis of a very dangerous law-suit.

There is no necessity for the architect's being the owner's agent for any purpose; he prepares the plans, specifications, and contracts not as an agent of the owner, but as his confidential adviser; if he is afterwards to act as superintendent, it is much safer in all cases that such superintendence should take the form of inspection coupled with a right to condemn the work if not done properly, rather than that he should have the actual direction and charge of the work. Where all agency and control of the work is withheld from the architect, it is much easier, as already pointed out, to hold the contractor to a strict accountability, and therefore before the passage of the Employers' Liability Act, it was the almost universal practice among lawyers drawing building contracts to insert a clause that the architect should not be the owner's agent for any purpose whatsoever. Since the passage of this act such a clause seems indispensable.

Then the authority given to the architect to determine the amount of loss by the owner in case of delay, and to pass upon the right of the owner to terminate the contract when the contractor is in default, is in effect to substitute the judgment of the architect for the will of the owner in matters which the latter is fully capable of determining for himself. We are unable to see what inducement there is for owners to surrender plain contract rights of this character to the determination of third parties.

The next objectionable feature that we notice is the multitude of arbitrations provided, sometimes by the architect, sometimes by outside parties. Arbitration clauses in building contracts are never of the slightest use to the owner, and should always be omitted. This is the advice of everybody who has ever written on the subject, and is the uniform practice of lawyers who are in the habit of drawing building contracts. The reason is that there is practically no method of enforcing the arbitration clause if the other party does not choose to arbitrate, and, in building disputes, the contractor always throws the arbitration overboard if he or his lawyer think they can get more from a jury. Moreover, arbitrations are notoriously more expensive than law-suits, and are seldom satisfactory to the owner, for the reason that arbitrators, if not lawyers, are apt, in making up their award, to take into account all sorts of considerations that are legally and justly wholly foreign to the case. On the other hand, if the parties really desire to arbitrate a dispute that has arisen, they can always do it whether there is any provision to that effect in the contract or not; in Massachusetts, a peculiarly advantageous arbitration can be had by first instituting an action at law and then having it referred under a rule of court to some one of the many lawyers who are in the habit of sitting as auditors in building cases. In such proceedings the expense of the auditor is borne by the county, and the parties have only to pay their counsel. As to the many small matters of detail that are constantly arising during the progress of building operations, the architect is the natural and usual referee; but no arbitration clause is needed to make him such if the parties desire to leave the matter to him.

Lack of space forbids us to continue this criticism, or to point out the many other impracticable and objectionable features of this contract, or to refer to the omission of certain clauses and provisions which have been found extremely useful in practice, as tending to prevent litigation and to protect the rights of the owner.

We will only add that this "standard form" of contract is founded on a total misconception of the actual and proper relations of the several parties to it. The architect is employed at the outset to

draw plans, specifications and contracts, and to devote to that purpose, in the interest of his employer, all the knowledge and skill which he possesses. He occupies a position of trust and confidence, being the professional adviser of his client, and his whole and sole duty is to him. The relation is substantially the same as that between solicitor and client, and it is as much the duty of the one as of the other to draw contracts solely with a view to the protection of his employer.

Architects, in drawing contracts, though generally more competent for that purpose than lawyers, on account of their greater familiarity with building methods, should always bear two things in mind: first, that their duty is to their employer, and to him alone, and in no sense to the contractor; and secondly, that the practical question in building litigation is not whether the work was in fact done properly, but whether a jury will find that it was; not whether the contractor was in fact told by the architect, as the owner's agent, to make certain alterations, but whether the jury will believe the testimony of the contractor and his workmen that an order was given, or the testimony of the architect that it was not. If the architect is to certify the progress of the work, he stands, in so far as the execution of that duty is concerned, in a somewhat different position, being bound to consider not the interest of the owner alone, but the actual facts of the case with truth and impartiality; but, in so far as the *drawing of the contracts* is concerned, he is simply the confidential and professional adviser of the man who employs and pays him.

We are at a loss to understand how the committee of architects appointed by the American Institute and the Western Association could have drafted such an instrument as this, unless these gentlemen agree with the writer of a recent text-book that the architect is the "recognized head of the building trade," employed by the contractor, rather than by the owner, and anxious to make trouble for himself, expense for the owner, and litigation for the courts.

SOCIETIES

PHILADELPHIA CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS.

At a meeting of the Philadelphia Chapter of the American Institute of Architects, held February 12, a committee was appointed to prepare a blank form of contract to be used between the architect and the owner. It is intended in this form to clearly state both the duties and the responsibilities of each party to the contract. Any blank forms of any similar contracts or any information on the subject would be very gladly received by Edward Hurst Brown, 1305 Arch Street, the Secretary of the committee.

ST. LOUIS ARCHITECTURAL LEAGUE.

At a regular meeting of the St. Louis Architectural League, held February 2, the successful competitors for December were declared to be: L. H. Seubert, First; M. P. McArdle and J. L. Wees, Second, both receiving same number of points; S. Carlisle Martin, Third. The subject was a "Mantel for the League Rooms."

The successful competitors for January were as follows: M. P. McArdle, First; L. H. Seubert, Second; E. R. Falkenheimer, Third. The subject was a "Porte Cochère for a Suburban Residence."

MISSOURI STATE ASSOCIATION OF ARCHITECTS.

Special prize competition offered by the Missouri State Association of Architects, the subject being a "Membership Certificate for the Year 1889." The successful competitors were: L. H. Seubert, First; H. E. Eames, Second.

Mr. T. B. Annon read a very interesting paper on "Construction."

Respectfully,

L. H. Seubert, *Corresponding Secretary.*

WASHINGTON CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS.

The Washington Chapter of the American Institute of Architects would be pleased to see any of the Institute or the Western Association members who may be visiting Washington during the Inaugural, at their room, No. 906 F Street. By calling on or addressing the Secretary, the freedom of the room will be gladly tendered them. One of the regular meetings of the Chapter will be held on the first of the month at 8 P. M., on which date the members will be pleased to meet visiting architects.

Glenn Brown, *Secretary*, 939 F Street.

BOSTON ARCHITECTURAL CLUB.

The Boston Architectural Club held its fortnightly *conversazione* Friday evening, the 15th, at the club-rooms, No. 6 Hamilton Place. The subject for discussion was "Methods and Mediums for Sketching." A few sketches in the various mediums were exhibited, and Mr. W. R. Emerson made some suggestions about architectural sketching, illustrating his remarks with sketches which he made before the Club. A sketch was first made with the pencil-point, then with pencil used flatwise, treating in masses of light and shade, rather than with lines. Next, he made a very spirited sketch with an English reed-pen, followed by one with a pen made from a stem of golden-rod, which Mr. Emerson has found to be very nearly as serviceable as the English reed-pen, and much more easily obtained. He then made one of his characteristic sketches with a common wooden tooth-pick, and finally showed what could be done with a pencil-smooch sketch. His sketches were exceedingly interesting, and were watched by the members of the Club with the closest attention.

The monthly exhibition of the Club will be held from Wednesday, the 20th to the 27th, inclusive, and will consist of water-colors by members of the Club. The list of exhibitors is quite large, including Ross Turner, E. C. Cabot, C. Howard Walker, R. C. Sturgis, F. H. Bacon, and others equally well known. The exhibition is not public, but tickets can be obtained through members of the Club.

COMMUNICATIONS

GREEK ARCHITECTURE.

Philadelphia, Pa., January 12, 1889.

To the Editors of the American Architect:—

Dear Sirs,—Permit me to explain more fully than I did in my rather hasty communication of January 25, my position in regard to the question of Grecian architecture. That the caryatid porch (so existing) of the Erectheum ever had a frieze is, I think, exceedingly improbable, for if we separate the architrave and cornice enough to insert one of the usual height (or, in fact, if we separate them at all) the proportion of outline is such as to strike the eye very unpleasantly at once, on account of the increase in height of the entablature from less than two-fifths to about one-half that of the columnar space, this proportion being greater than those corresponding in the early *Doric* temples dating approximately to the sixth century B. C. Aside from this the construction of the panelled ceiling is such as to preclude the probability of a change after the porch was built.

The fact, however, that the antæ continue down to the stylobate behind the stereobatic platform, and form long vertical joints with the rubble backing of the latter, points to the possibility of the porch having existed at one time as an ordinary columnated portico built upon the stylobate, in which case the entablature may have been built as usual, this would make it in height equal to one-fourth that of the column, which proportion corresponds to those of the other porticos of the building. (These figures are merely approximate; I do not believe that the Greek architects built their temples as mathematical puzzles for the benefit of modern archæologists.) The frieze might then have been removed to preserve the correct proportion of parts when the portico was rebuilt in the caryatid order. This, of course, is merely speculative, and I should be pleased to hear of any other opinion, or anything definite upon this peculiar construction.

I did not intend to bring up the long contested question as to whether the Grecian temples received their chromatic decoration, exteriorly, at the hands of their builders, or at a later time: that they were so decorated in the best period is now, I believe, generally admitted. Neither do I wish to insist upon the ideas which long forbade the acceptance of this truth, and which are held in just contempt by "The Writer of the Article," but the fact that traces of design in crude color have been found upon the temples is not by any means conclusive evidence that the final coloring was of a debased type—either intrinsically or in comparison with our standard.

That the element of beauty in Classic art is a vital one, although thoroughly opposed to the intrinsic principles of everything associated with the romantic period is, in spite of individual preference, established by long ascendency in times perhaps productive of the greatest human culture that the world has known, and also by its subsequent, frequent resurrections. This being so, why should the Greeks—who deserve the credit not only of their own exquisite work but of so much that followed, and who were so successful in form and detail—fail in the problem of color? Such an assumption I cannot think warranted by the light already thrown upon the subject.

Will "The Writer of the Article" pardon me if I assume that it would have been a stranger insensibility on the part of Phidias, who created the chryselephantine statue of Athene—famous in Greek literature for its beauty and splendor—to have painted those of the gods and heroes without—several of which are regarded on account of their exquisite modelling to be the finest works known to modern artists—like gorgeous harlequins, or to have placed them in juxtaposition to work treated in such a manner?

Very truly, Herbert P. Kelly.

TORONTO BOARD OF TRADE COMPETITION.

NEW YORK, N. Y., February 18, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Your report on this competition, evidently inspired by a disappointed competitor, is so glaringly incorrect in every particular that we ask your permission to make the following statement of facts:

We take the "faults" referred to, in the order in which they occur.

1. As to lighting. There will not be a dark corner in the building. The staircase and elevators, together with a large proportion of the corridors, are lighted by three large windows (each 7′ 0″ x 4′ 0″) on every floor; the very short lengths of corridor from which these windows are not *distinctly visible*, will receive abundance of light from the glass-doors and fan-lights.

2. Ventilation and warming. We venture to promise that there is not a building in the Dominion of Canada more efficiently warmed and ventilated than this will be. The extreme simplicity of the general scheme of the building greatly favors us in working out those very important matters.

The water-closets and urinals are all provided with special ventilation; they will *not* ventilate into the area, but into steam-heated shafts.

3. *At our own suggestion*, the public restaurant in the basement is omitted altogether.

4. The entire basement is given up to boilers, coal, dynamos, etc.

5. There will be no banking-room at all; that was merely an alternative suggestion — not our main scheme.

6. The "clerk's room," on our original plan, owed its position to a printer's error in the "instructions," an error which we leave our critic to discover for himself.

7. Your correspondent seems to be ignorant of the fact that by surrounding the central stack of fireproof vaults with a corridor, we render them, humanely speaking, absolutely secure from fire, as well as from the attacks of burrowing burglars.

These vaults would probably be rented to the tenants of the largest offices on each floor, immediately opposite the vaults.

8. The building contains sixty-two offices, of which twenty are twenty feet deep.

Ten of these deep offices (three hundred superficial feet in area) have not less than ninety superficial feet of window area; the remaining ten have forty-five feet of window area, which is above the average allowance.

9. The "closets in every direction," on the Board of Trade floor, owing to the circular form of the large hall, reduce themselves, in actual fact to *one*, in the secretary's private office.

10. There remains the question of cost. On this matter we have a well-grounded confidence that your correspondent will be utterly disappointed

Is the dense ignorance displayed by your correspondent careless, or malicious? It savors strongly of both.

Yours truly, JAMES & JAMES.

THE COLUMBIA COLLEGE ARCHITECTURAL COURSE.

CHICAGO, ILL., January 24, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I desire to ask a few questions *apropos* of your reply to Mr. Kimball, concerning Columbia College as "the best school of architecture" in America.

By your first statement do you mean to imply that other institutions — notably the one at Boston — have not "corps of instructors of long and wide experience?" If so, I consider the statement unjust, for architecture is so largely a matter of personal instruction that tabulated diplomas and certificates of "experience" count for little in results. What do the results of training show?

Second, is a course of four years' duration, compulsorily undertaken, of more benefit in itself than a course of the same length which is voluntary?

I will not question your third statement, not wishing to enter a discussion on rival "equipments."

Fourth, in consideration of the fact that the faculty of the Ecole des Beaux-Arts — acknowledged by all to be the best school for the profession in the world — is of the so-called "narrow-minded and unprogressive" variety, is progressiveness, especially in these days of harum-scarum innovation, to be regarded as an unmixed blessing at the start?

Fifth, in consideration of your publication of architects' votes on the merits of buildings in this country, do you think that New York is the acknowledged centre of the highest architectural art in the country? Respectfully, HOWARD G. HODGKINS.

[WE will print our correspondent's questions, while we must decline to answer them, since by answering we should seem to acknowledge the truth of his inference that, because we made certain absolute statements concerning Columbia College, only the converse of those statements could be true of those institutions which were not mentioned. Our correspondent's amiable *esprit de corps* has caused him to institute comparisons which were not made. — EDS. AMERICAN ARCHITECT.]

NOTES & CLIPPINGS

VALUE OF BERLIN REAL ESTATE. — The enormous rise in the value of property at Berlin is shown by the fact that the Hôtel du Nord has just been sold to the German Discount Society for £175,000, whereas in 1864 it was purchased for £40,000, and in 1843 for £18,000. — *London Truth.*

A POSTAL TUBE FOR THE CHANNEL. — One of our English contemporaries has the following item of interest respecting a projected postal tube under the English Channel, to be operated presumably by the pneumatic method of propulsion, though on this point "deponent saith not," viz: — "Whatever objection may be urged against the construction of a Channel Tunnel, it is not easy to discover grounds for opposing the development of a recently revived scheme. It is proposed (not for the first time, however,) to lay down a postal tube between Dover and Calais. The idea is to suspend two tubes of about a yard each in diameter by means of steel cables across the Channel, forty yards above the level of the sea. The steel cables will be fixed to pillars at distances of about 800 yards, and in each tube a little railway will run with cars capable of carrying 450 pounds in weight. No parcel of greater weight that this will be taken, and the cost is estimated at the modest figure of £1,000,000." — *Iron.*

RUINS IN THE CHIAPAS DISTRICT, MEXICO. — An interesting antiquity has recently been discovered at Palenque, in the Chiapas district of Mexico. The monument is situated upon the River Xhupa. Although it is now a complete ruin, it was originally a structure of considerable height; as three distinct stories are still distinguishable. The ground-floor is very large, measuring some 120 feet by 75 feet. The floor above is attained through holes in the ceiling or vault, and here a room is found measuring some 27 feet by 9 feet. The openings referred to are natural and have been formed by the disintegration of the stone and the sinking in of the roof. On stone slabs set into the wall are bas-reliefs of human figures, warriors, etc. Although these stones are in a very bad state of preservation they are to be sent to the capital of Chiapas. Near this ruin are a row of houses forming a street, and not far from these the vestiges of quite a large town, all of course in a state of complete ruin. — *Scientific American.*

PREPARING FOR A SETTLING OF THE EIFFEL TOWER. — During the last forty-eight hours the great question for Parisians has been whether M. Eiffel's tower, now some two hundred and fifty metres high, is in danger of falling. Within the last few days many people, chiefly those living in the neighborhood of the Champ de Mars, have been examining the huge iron structure, and, after looking at it with plumb-lines held between it and their eyes, have come to the conclusion that it does not stand straight. The result has been that all Paris went to look at the tower to-day. In the afternoon the Trocadéro, the quays, and the bridge were constantly crowded with spectators contemplating the structure. The question had on Saturday caused such a commotion in the vicinity of the Champ de Mars that it became necessary to have the condition of the edifice officially vouched for. The engineers of the exhibition works consequently met those of M. Eiffel, and proceeded with great care to examine the structure with their theodolites from every point of view. Their verdict was that the structure leaned neither to the right nor to the left, but stood perfectly straight. This is reassuring information for those who live near the Champ de Mars, but I doubt whether the simultaneous announcement, "Precautions have been taken to put the tower straight, if ever it does show an inclination to lean over," is equally so. It appears that, in view of the possibility of such an occurrence, a complicated system of machines has been placed at the base of the edifice, designed to put it straight if ever it should deviate from the perpendicular. This mechanism, which is hidden in the brickwork, will, it is stated, if ever required, be put in motion by a hydraulic press of 800 tons power. By its aid it will be easy to remove one or more of the thin plates of steel now resting between the brick foundations of each of the four feet of the tower and the iron girders, and thus right the giant edifice speedily. — *London Standard Paris Correspondence, January 8.*

FELLING TREES BY ELECTRICITY. — Hitherto machines for felling trees have been driven by steam power, but this is sometimes inconvenient, especially in thick woods, and electric power has recently been adopted in the Galician forests. Usually in such machines the trunk is sawed, but in this case it is drilled. When the wood is of a soft nature the drill has a sweeping motion and cuts into the trunk by means of cutting edges on its sides. The drill is actuated by an electric motor mounted on a carriage, which is brought up close to the tree and shackled to it. The motor is capable of turning round its vertical axis; and the drill is geared to it in such a manner that it can turn through an arc of a circle and make a sweeping cut into the trunk. The first cut made, the drill is advanced a few inches and another section of the wood removed in the same way until the trunk is half severed. It is then clamped to keep the cut from closing, and the operation continued until it would be unsafe to go on. The remainder is finished by a hand-saw or an axe. The current is conveyed to the motor by insulated leads brought through the forest from a generator placed in some convenient site. — *London Times.*

A GERMAN WHITEWASH. — A German paper publishes a formula for a wash which can be applied to lime walls and afterwards become waterproof so as to bear washing. Resenschek, of Munich, mixes together the powder from three parts silicious rock (quartz), three parts

broken marble and sandstone, also two parts of burned porcelain clay, with two parts freshly-slaked lime, still warm. In this way a wash is made which forms a silicate if often wetted, and becomes after a time almost like stone. The four constituents mixed together give the ground color, to which any pigment that can be used with lime is added. It is applied quite thickly to the wall or other surface, let dry one day, and the next day frequently covered with water, which makes it waterproof. This wash can be cleansed with water without losing any of its color; on the contrary, each time it gets harder, so that it can even be brushed, while its porosity makes it look soft The wash or calcimine can be used for ordinary purposes, as well as for the finest painting. A so-called fresco surface can be prepared with it in the dry way. — *Invention.*

Women Iron-Workers. — There are probably a thousand women working in the iron-mills in Pittsburgh, making bolts, nuts, hinges and barbed-wires. Three years ago, owing to a difficulty with the men working in the bolt-mills, the proprietors decided to try women, and since that time they have been employed very generally in all the iron-works. Women are also employed in Pratt & Letchworth's malleable-iron works at Black Rock, N. Y. Four years ago the proprietors engaged two young women to do office-work. That they employ ten women in that department to-day is proof of the success of this movement. The firm employ in all about 150 women in the different departments. The work there is all piecework, and the young women earn about $6 per week. The more expert earn more. They do work that is usually done by boys, but one of the proprietors says: "We find the girls more attentive to business and more faithful; they are nearly all under twenty years of age, and it is our experience that girls of fourteen know more than boys of the same class at eighteen." "When they get through their work they wash every suspicion of dirt from faces and hands, change their shoes and gowns and smooth their hair. Then they don comfortable and becoming wraps and hats and sally forth. No one, from their appearance, could guess that they had not been handling ribbons and laces all day over a dry-goods counter instead of operating oily and face-blacking machinery." — *Springfield Republican.*

Portland, Conn., Sandstone. — Some of the redstone quarrymen to the east of this city have been agitated by a report that the supply of the famous Portland sandstone or freestone on the Connecticut River, opposite Middletown, was limited, and that for this reason New York builders were getting into the habit of using pressed-brick in its stead. Investigation shows the rumor to be totally without foundation. None of the quarrymen can tell where it sprung from, but it is probably a revival of a similar story which it appears has floated about the Connecticut Valley with greater or less regularity ever since the Portland quarries were opened. The remarkable deposit of sandstone at Portland covers an area of over 200 acres, and is practically inexhaustible. It lies in horizontal strata, usually with each stratum in the upper levels varying a trifle from the others in the fineness of the sand. In one of the three large quarries now worked several acres have been quarried to a depth 200 feet below the surface, and as an experiment some time ago to decide the probable depth of the sandstone, a diamond drill was started down from the bottom of the 200-foot level. It was driven down 312 feet without reaching the bottom of the deposit, making 512 feet in all. The core that was taken out showed no material change in the character or quality of the stone. Illustrative of the recent rumor it is remembered that in 1715 the Middletown people became frightened because of the extensive quarrying of the stone that was being carried on and passed a law prohibiting people from quarrying the stone for transportation out of the town. — *New York Times.*

Pit Props. — In the Landes district of western France, on the Gironde, the soil is sandy and will grow little but pines, of which forests have been successfully cultivated. The inhabitants subsist almost exclusively upon the revenues derived from the production of pit-props, railway-ties, telegraph-poles, fuel and resin. The annual shipments of pit-props from Bordeaux to England now amount to about 175,000 tons, which is twice as much as was shipped ten years ago. The ties and poles are used mainly in France. A large quantity of young pines are also shipped to England for manufacture into paper. The poorer classes, especially those farthest from transportation facilities, give their attention to resin, but there is said to have been a serious decline in the exportation of that article from Bordeaux through competition from the United States, which has greatly increased its exports, and is the chief source of supply. This has been a serious misfortune to the inhabitants of the Landes district. Pine oil is made from the refuse of resin left in making turpentine. It is used extensively in Bordeaux as an illuminating oil. It burns brightly, is cheaper than petroleum and is non-explosive. It is also prepared and sold to some extent in this country, patents having recently been taken out for its production. In France the pine does not appear to suffer from the extraction of resin, where care is used, but on account of it the wood is said to be better fitted for certain purposes, such as the manufacture of paper and pyroligneous acids. The Landes forests are all of comparatively recent origin. — *Northwestern Lumberman.*

Steel-Girders. — The substitution of steel for iron in girder manufacture appears to be making steady progress. The *Moniteur des Inerts Materiels* states that for the large new warehouses in course of erection at Buenos Ayres steel-girders are specified, and that, as these cannot be advantageously obtained in Belgium, the contractors, Halot & Company, Louvain, have had to place the order with the Rothe Erde Works, in Germany, a concern which makes a specialty of this kind of work. As the order is for 5,000 tons, the Belgian iron-girder rollers are asking themselves to what extent steel-girders are likely to replace iron in the future, and how far their present practical monopoly of the export business in large rolled-girders is threatened by this preference for steel. The *Moniteur* draws comfort from the reflection that while for the nine months ending September 30, the export of steel from Belgium was only 80,000 tons, the shipments of manufactured iron reached 210,000 tons. — *Iron Trade Review.*

TRADE SURVEYS

Among the notable incidents of the past week in trade and manufacturing circles are the notice of a 5 to 12 per cent reduction in wages among the iron-workers of Eastern Pennsylvania; the further progress of negotiations among Northwestern railroad presidents for the establishment of freight schedules; the organization of companies for manufacturing South of the Ohio River, capitalized at twenty million dollars; the strengthening of Southern lumber associations in view of an increasing demand for Southern mill products in the North; an increase of 4 1-2 per cent in railroad gross earnings of given roads during January; improving export trade prospects and an enlarging domestic distribution of mill, shop and factory productions; more rails and railway material have been put under contract this year than last. The copper syndicate is forced to recognize the fact that there will be a probable surplus of one hundred and fifty million pounds of copper in the United States this year to take care of, besides increases in other quarters of the world, which were not fully taken into account when the combination was formed. Lumber manufacturers in Virginia, representing 800,000,000 feet per annum, held a convention at Norfolk, Va., recently, to form a protective association in the interest of higher prices. The Georgia Railway Commission is endeavoring to secure evidence that the recently formed yellow-pine combination in that State is illegal. The white-pine manufacturers of the Northwest are advised by very excellent authority not to run their mills to full capacity on account of the large supply of yellow-pine coming into that section. The recent auction sale of fifteen million feet of hemlock at Williamsport, Pa., shows an advance in one year of 50 cents to $1 per thousand. The Southern shingle manufacturers meet in New Orleans, March 7, to restrict production and mark up prices. The most significant feature in the lumber trade is the wonderful development of Southern Territory and the inroads that Southern lumber is making throughout the North from the coast to the Rocky Mountains.

North Carolina mountaineers are establishing offices in Chicago for the distribution of their products throughout the Northwest. Oregon fir and cedar and California redwood is crowding East. Architects are using a greater variety of woods, and builders are experimenting with substitutes for products heretofore used, all of which is stimulating demand for newer kinds of wood in all channels of trade. Trade indications are that lumber will rule low all this season, a fact which is proven by the hand-to-mouth policy of wholesalers and retailers. The downward tendency in prices growing out of increasing manufacturing and transportation facilities is offset partly by the growth of the spirit of and necessity for trade combinations. The Southwestern yellow-pine manufacturers met at Texarkana, Mo., on Thursday of last week, and took steps to control production in the direction of higher prices. Lumber magnates in Wisconsin are preparing to build a long line of road to connect with the Union and the Canadian Pacific roads, by which the Northwestern lumber interest, or a considerable percentage of it, can have a new trans-continental line, independent of the roads which now control the lumber traffic of that section. Business in lumber in the aggregate all over the country has been larger since January 1, than for same time last year. The general expression of opinion privately among the builders at their National Convention in Philadelphia, last week, was that it was probable more building would be done this year than last. Building enterprise is starting out well throughout the New England States. At New York, 250 buildings were projected in January, which, it is estimated, will cost $2,000,000 more than the projected work of January last year. A corresponding improvement is apparent at Philadelphia. No discouraging reports are heard from farther Western cities. The successful adjustment of railroad questions in the Northwest will strengthen confidence in more than railroad circles, but nothing less than a material expansion in traffic will bring permanent peace to the warring railroad interests. Railroad earnings on one hundred and eleven roads for the first month of the year exhibit an increase of nearly four-and-one-half per cent in gross earnings over same month last year. Last year, imports increased two per cent, and exports declined three-and-one-fourth per cent. But little iron and steel are arriving, and American makers are prudently restricting output to actual requirements. Brick-makers are making active preparations wherever weather permits for an enlargement of output, particularly in the interior, where new industries are springing up.

The brick-machinery makers have no less work on hand than they have had for months, and in some Western works the orders on hand will engage the capacity to June 1st. Brick is entering much more generally into construction of new houses and works than a few years ago. A better class of work is apparent. Most of the works constructed are larger, have more capital behind them and their owners are looking further ahead, than when the industries were struggling for existence. One authority estimates that over one hundred large brick works are projected at this time. Since last September two hundred saw and planing mills have been begun or projected in the country so far as records show. On March 1st, the present restriction among sash, door and blind manufacturers in the West terminates and each manufacturer can then produce to suit himself. The manufacturers of building materials and house and mill supplies have looked very carefully into trade conditions and prospects and they feel that as much money will be expended in these channels as last year. Wall-paper makers have sold the bulk of their stock. Carpet makers are speeding up, cotton-goods manufacturers, North and South, are quite busy though late reports show that average dividends run only from six to eight per cent. This fact does not seem to check cotton-mill building enterprise, for since January 1st, one half more has been projected than for the first two months last year, so far as reports of projections show. The improving conditions are not universal, however. There are weak spots here and there, little or no profits, enlarging obligations and so on; but sizing up all interests the country is gaining in strength and activity, and confidence in future prosperity is general. Yet the bottom fact must never be lost sight of, that the country's financial system is slipping away and no sufficient substitute has been suggested. The most abundant prosperity and superhuman energy cannot stand up against a weak financial system. Political parties have not a word to say on this topic and business men are too busy making dollars. Yet the necessity for a new system is growing apace and in time the leaders in the nation's enterprises will come to recognize that some preparation must be made for the change that is rendered imperative by the gradual extinction of the public debt.

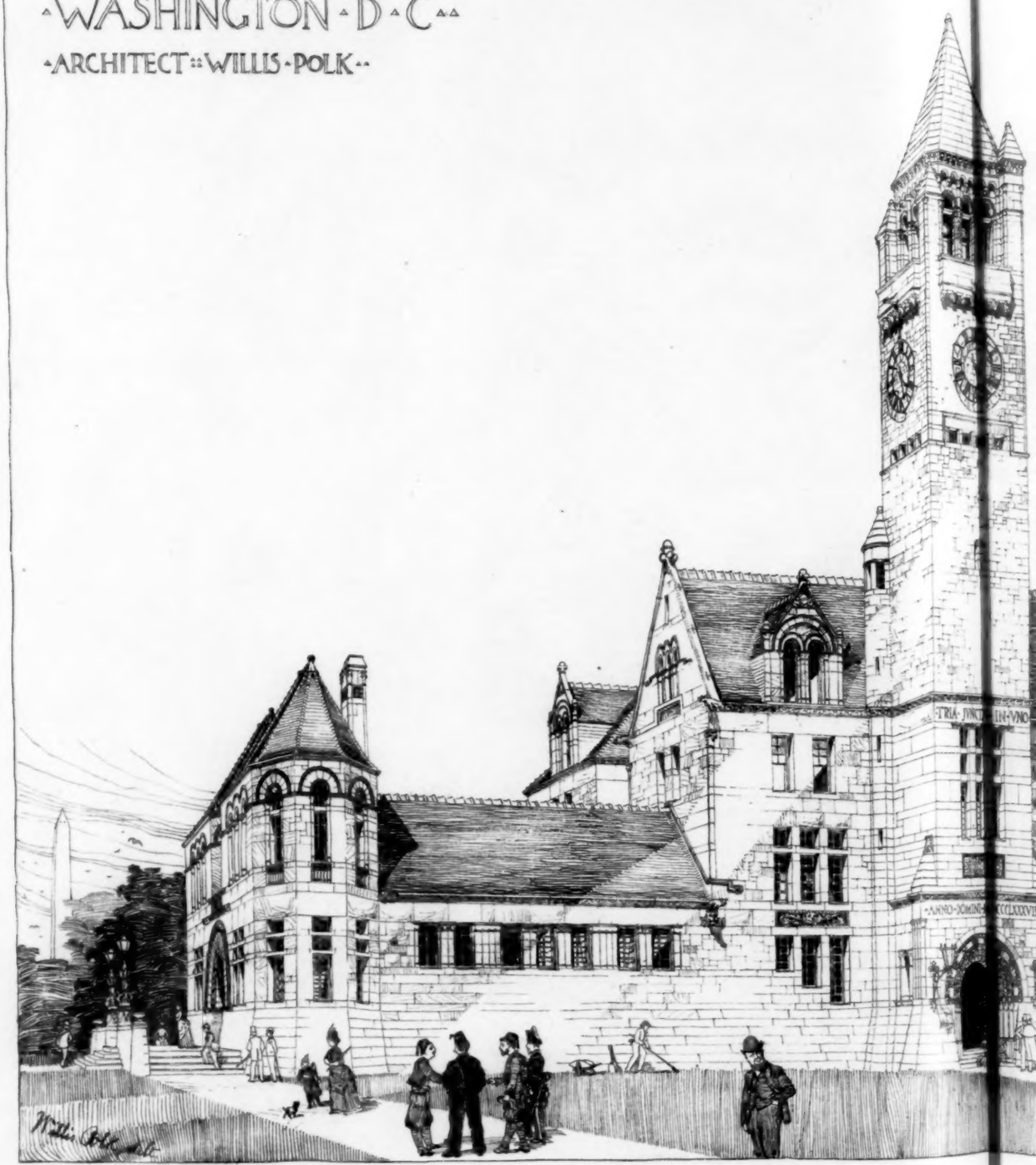
S. J. Parkhill & Co., Printers, Boston.

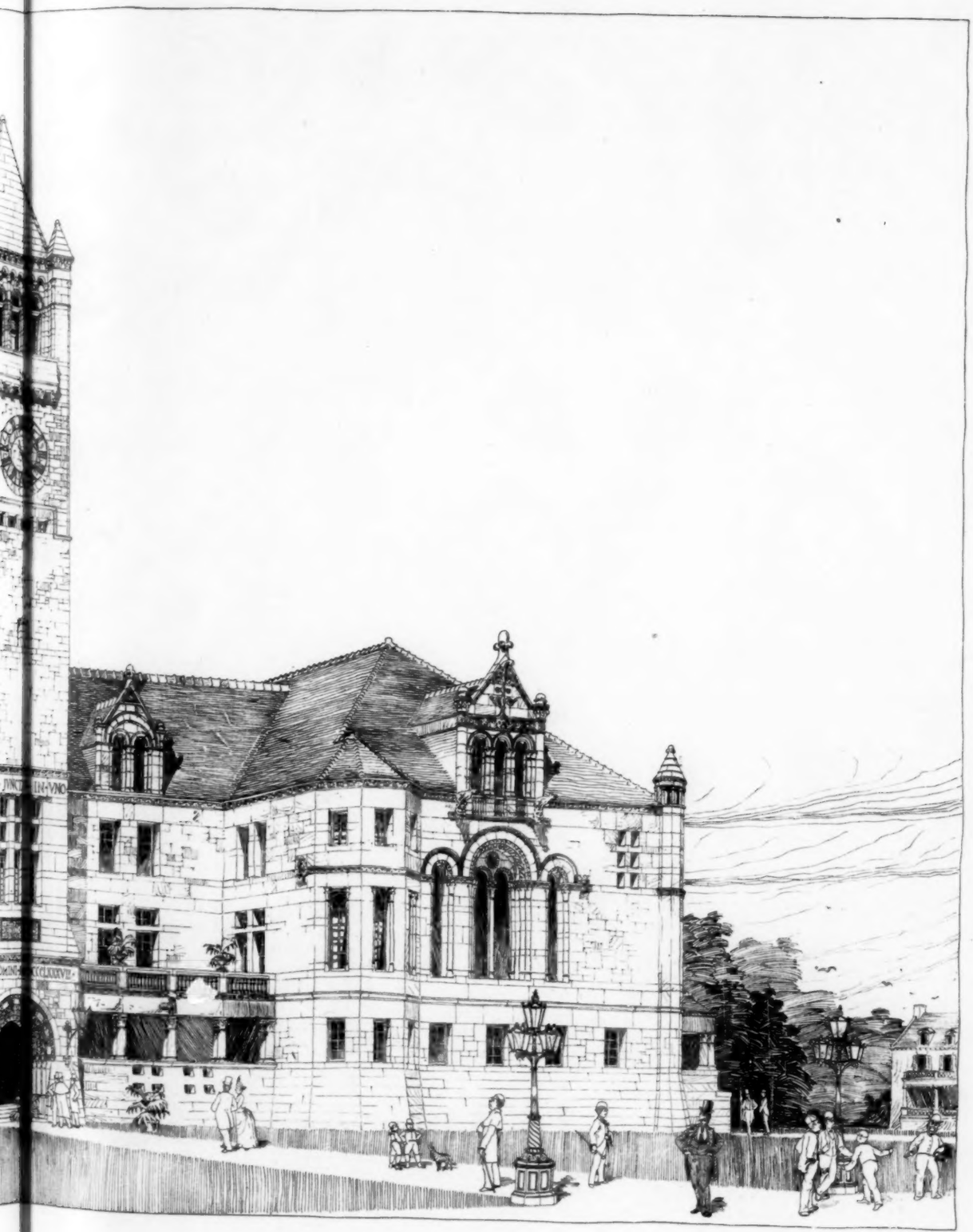
COPYRIGHT 1898 BY ROBERT C. SPENCER, JR. & CO.

PROPOSED MUNICIPAL BUILDINGS

WASHINGTON D C

ARCHITECT :: WILLIS POLK



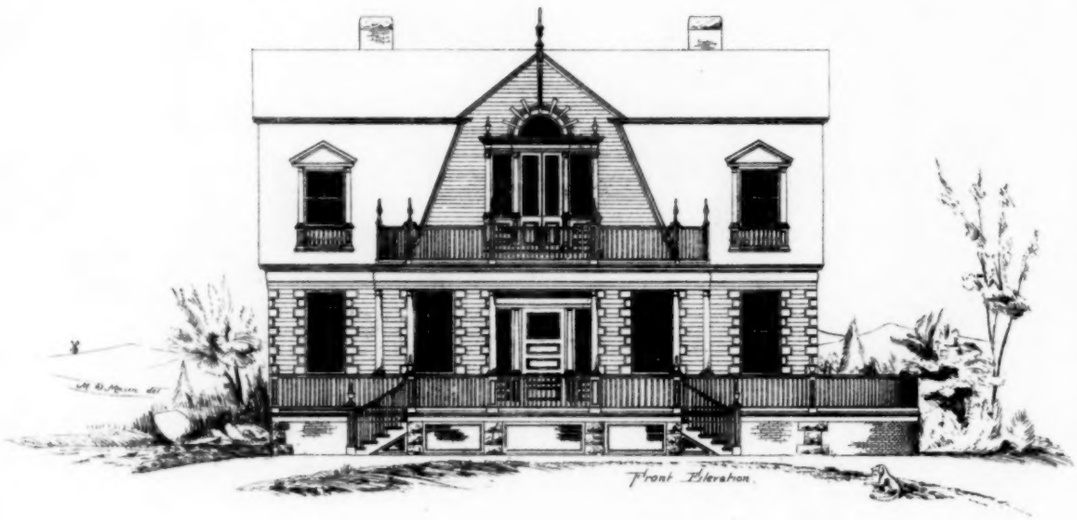


Heliotype Printing Co. Boston.

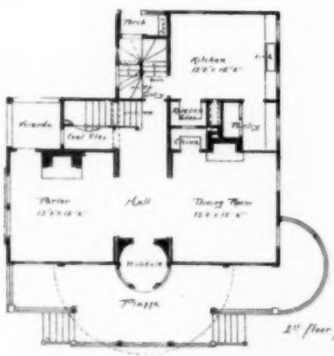
COPYRIGHT 1888 BY TICKNOR & CO

Rear Elevation

Side Elevation



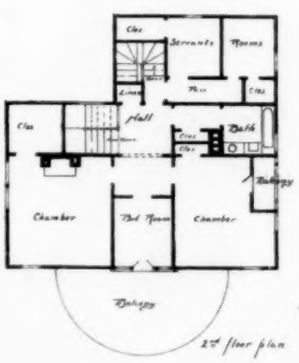
Front Elevation



2nd floor plan

ONE
OF
FIVE COTTAGES
TO BE BUILT AT
WATCH HILL R.I.

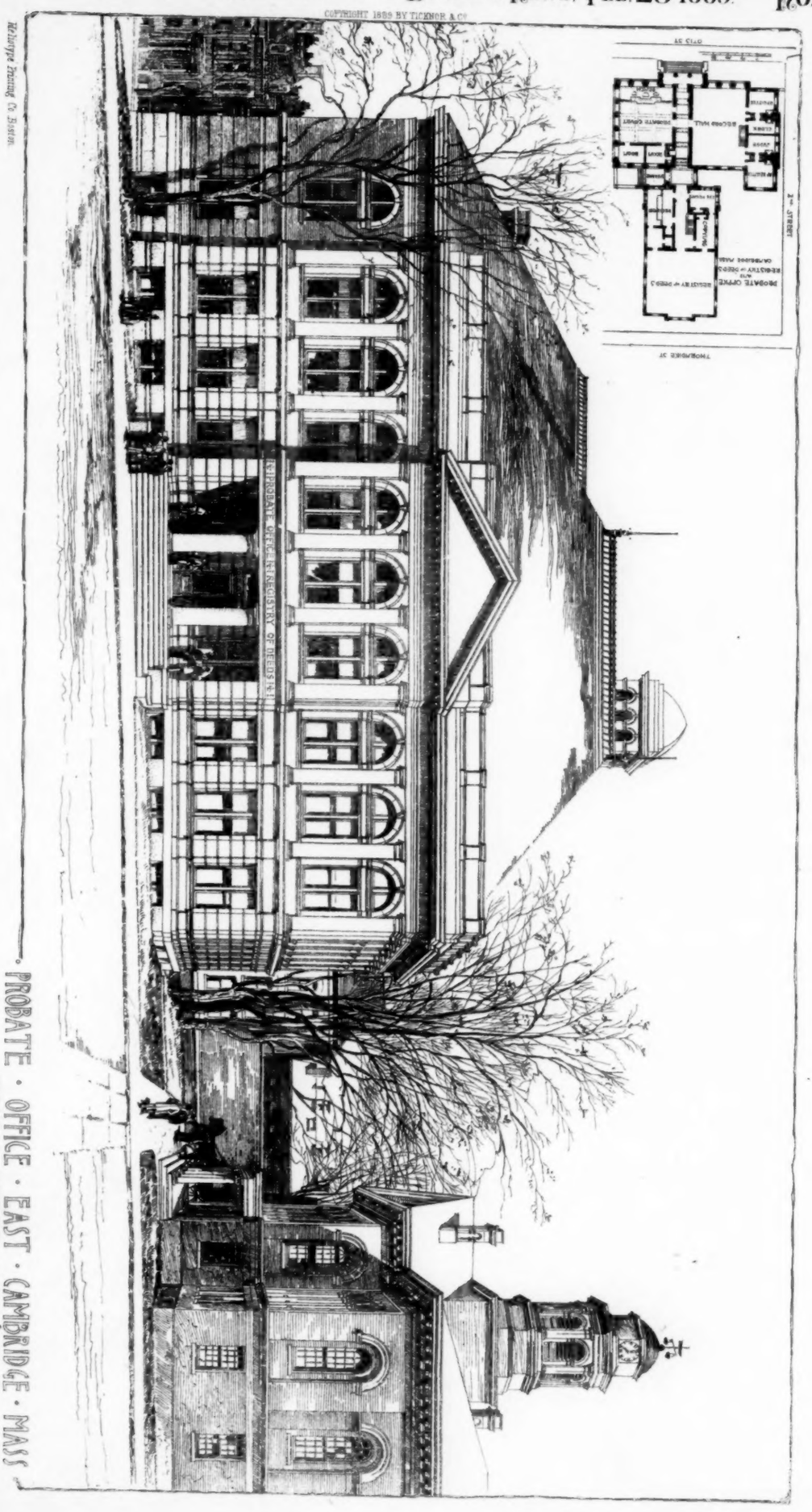
HOWARD HOPPIN, ARCH'T.
PROVIDENCE,
R.I.



2nd floor plan

Heliotype Printing Co. Boston.

COPYRIGHT 1889 BY TICKNOR & CO.

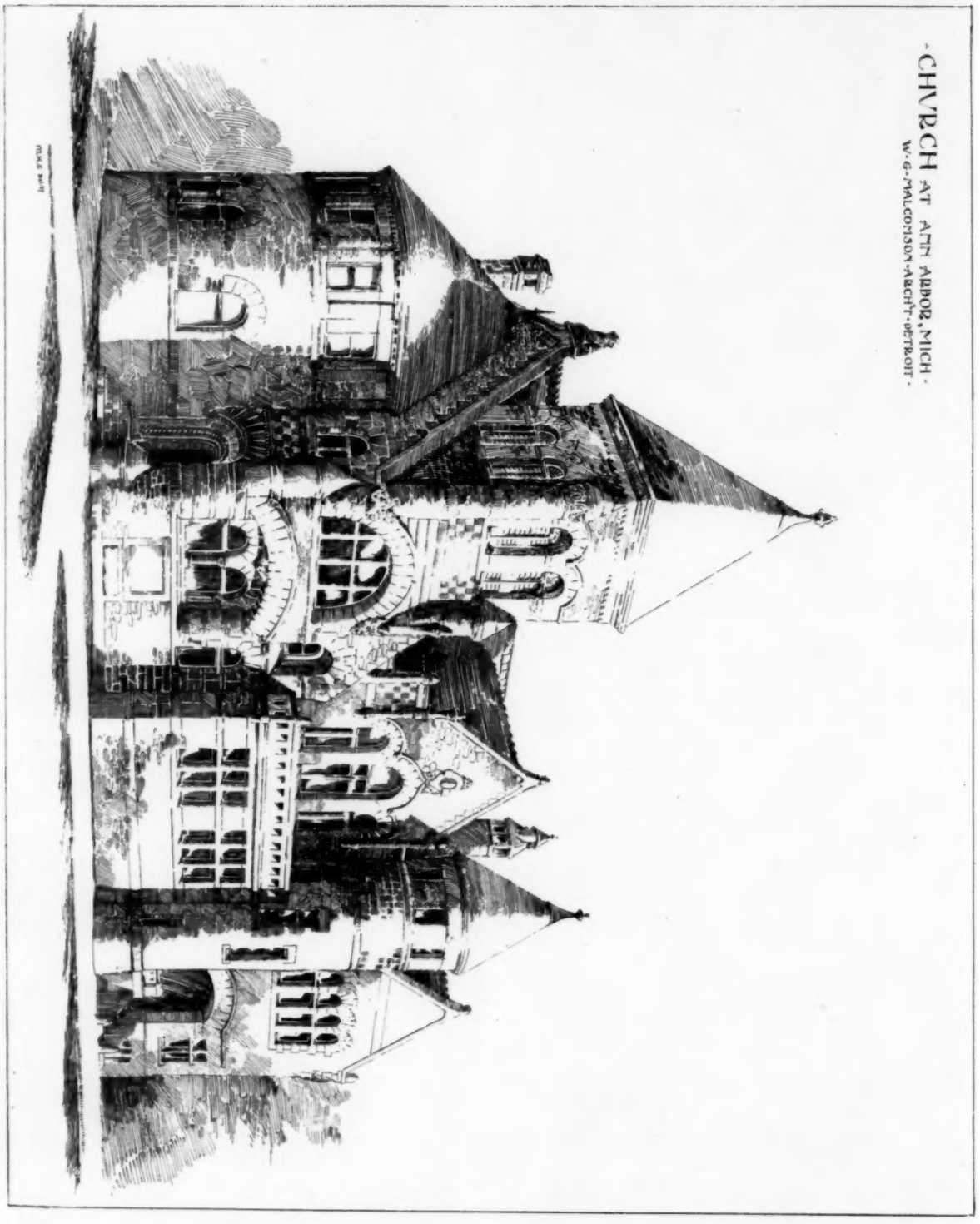


McIntyre Printing Co. Boston.

PROBATE · OFFICE · EAST · CAMBRIDGE · MASS.

WAIT & CUTTER · ARCHTS.

COPYRIGHT 1889 BY TICKNOR & Co

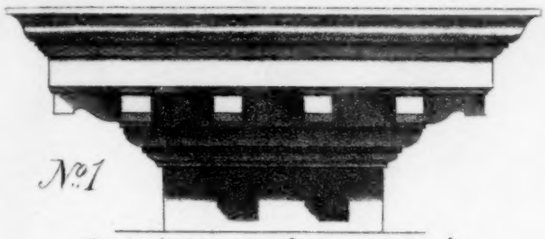


CHURCH AT ANN ARBOR, MICH.
W. G. MALCOMSON ARCH'T. DETROIT.

Heliotype Printing Co. Boston.

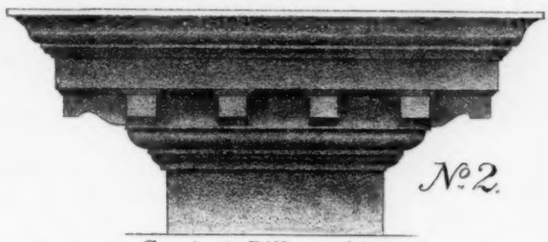
COPYRIGHT 1889 BY TICKNOR & Co

Architectural Shades and Shadows. — Plate I.



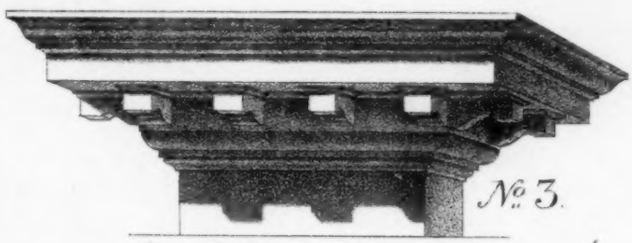
No. 1

Cornice in Direct Light: *Conventional.*



No. 2.

Cornice in Diffused Light.

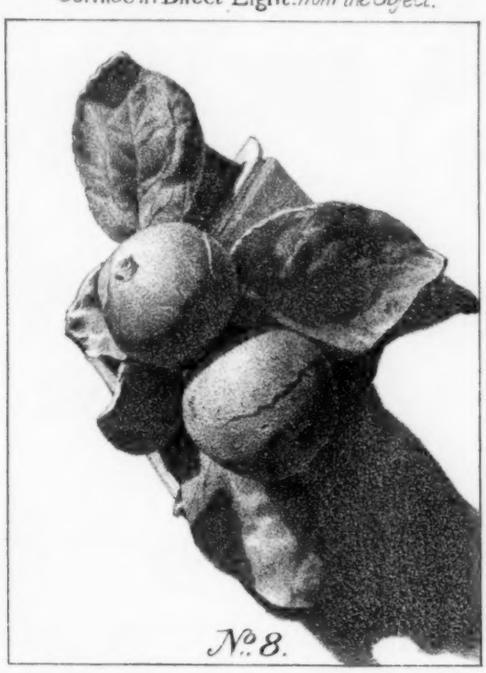


No. 3.

Cornice in Direct Light: *from the Object.*

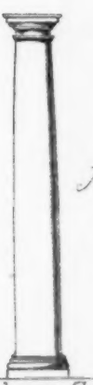
No. 4.

Doric Column: *Large Scale.*



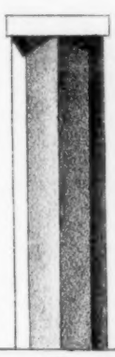
No. 8.

Shade & Shadow on Plaster Cast.



No. 5.

Doric Column: *Small Scale*



No. 6.

Octagonol Pier and Cap.

No. 7. Elevation showing Aërial Perspective.

A.D.F. Hamlin del. '88

Heliotype Printing Co. Boston